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East Central Oklahoma State Univ, Ada

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Robert S Kerr Environmental Research Lab, Ada, OK

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Robert S. Kerr Environmental Research
Laboratory
Ada OK 74820

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A Bibliography with Abstracts
Volume V

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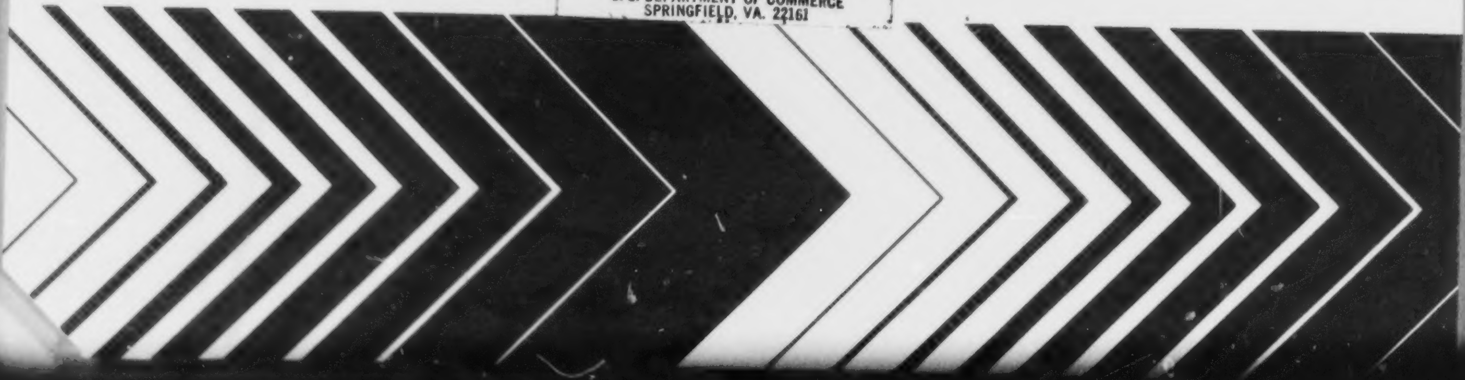

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Management and research information on animal wastes has expanded in recent years. This material has appeared in such diverse sources as journal articles, conference papers, university publications, government publications, magazine articles, books or book chapters, and theses. This bibliography was compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology.

Included in this publication are the following indexes: (1) author, (2) animal information categories. These indexes are followed by a section of abstracts of each reference entry found in the bibliography. Single copies of most articles can be obtained in hard copy or microfiche form at cost from the Animal Waste Technical Information Center, School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma 74820.

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LIVESTOCK AND THE ENVIRONMENT

A Bibliography with Abstracts

Volume V

by

M. L. Rowe
Linda Merryman
Animal Waste Technical Information Center
School of Environmental Science
East Central Oklahoma State University
Ada, Oklahoma 74820

Grant No. R-805151

Project Officer

R. Douglas Kreis
Source Management Branch
Robert S. Kerr Environmental Research Laboratory
Ada, Oklahoma 74820

ROBERT S. KERR ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
ADA, OKLAHOMA 74820

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FOREWORD

The Environmental Protection Agency was established to coordinate administration of the major Federal programs designed to protect the quality of our environment.

An important part of the Agency's effort involves the search for information about environmental problems, management techniques and new technologies through which optimum use of the nation's land and water resources can be assured and the threat pollution poses to the welfare of the American people can be minimized.

EPA's Office of Research and Development conducts this search through a nationwide network of research facilities.

As one of these facilities, the Robert S. Kerr Environmental Research Laboratory is responsible for the management of programs to: (a) investigate the nature, transport, fate and management of pollutants in groundwater; (b) develop and demonstrate methods for treating wastewaters with soil and other natural systems; (c) develop and demonstrate pollution control technologies for irrigation return flows, (d) develop and demonstrate pollution control technologies for animal production wastes; (e) develop and demonstrate technologies to prevent, control or abate pollution from the petroleum refining and petrochemical industries, and (f) develop and demonstrate technologies to manage pollution resulting from combinations of industrial wastewaters or industrial/municipal wastewaters.

This report is a contribution to the Agency's overall effort in fulfilling its mission to improve and protect the nation's environment for the benefit of the American public.

William C. Galegar

William C. Galegar, Director
Robert S. Kerr Environmental
Research Laboratory

ABSTRACT

Management and research information on animal wastes has expanded in recent years. This material has appeared in such diverse sources as journal articles, conference papers, university publications, government publications, magazine articles, books or book chapters, and theses. This bibliography was compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology.

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This report was submitted in fulfillment of Grant Number R-805151-01 by the School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma, under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period March 1, 1977, to February 28, 1978, and work was completed as of February 28, 1978.

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The project staff extends its gratitude to the authors and publishers for use of their publications in these bibliographic entries. Work contributed by Laurin Patton, Assistant Professor in the School of Environmental Science at East Central Oklahoma State University, is deeply appreciated. Special thanks is also extended to EPA Project Officer R. Douglas Kreis for his assistance in the preparation of this bibliography.

SECTION 1

INTRODUCTION

Evolving regulations and aims pertaining to pollution abatement and control have necessitated a timely and well-dispersed flow of pertinent information concerning animal waste management so that capital investments in the animal production industry can be made on the basis of the most recent research and operational findings. In many activities, industrial and manufacturing organizations or associations provide the linkage channels through which such information may flow. The wide range in operation sizes and makeup, the geographic distribution of production units, the variations in climatic and geographic factors, and the dictates of the local or regional markets make widespread dissemination of animal waste management information difficult even through the established communication networks such as breed associations, farm organizations, and the popular agricultural press. Common properties and characteristics of animal wastes enable technological transfers to occur in the production operations from one species to another. Publicizing practices of findings in one segment of the livestock production industry can spread new ideas and techniques to other segments of the industry.

The objective of this project is to facilitate the dissemination and technological transfer of information on the management and disposal of animal wastes throughout the livestock industry. Identification and location of pertinent information generated in the production operations of poultry, swine, cattle, fish, and other animals of economic interest raised in open or confined systems is accomplished through searches of technical journals; books; theses; reports from private, state and federal agencies; papers given at meetings of professional societies or symposiums; and articles appearing in the trade or production-oriented "farm" magazines.

The search topics of specific interest include: (1) The environmental impact of animal production activities on water, groundwater , air, soil systems, health, and aesthetics. (2) Feedlot, confinement pen, rangeland, and pasture land management, including animal waste management; the use of chemical fertilizers, manures, green manures, and sewage sludge in conjunction with animal production areas or animal production-related areas; and pollution effects of crop residues, soil losses and sediments production from animal production areas to animal production-related areas. (3) Legal, economic, and social constraints. (4) Research and development. The project staff will maintain a file copy of all articles which appear in the bibliography. Upon request to the project staff, users will be supplied a copy of individual articles at cost provided that copyright permission has been obtained.

An updated bibliography of animal waste management information is prepared annually. It contains entries and abstracts for all new items maintained in the collection at the Animal Waste Technical Information Center.

It is anticipated that users of this bibliography will secure pertinent publications from local libraries or through interlibrary loan. However, single copies of most publications (those for which copying approval has been obtained from copyright owners) may also be obtained upon request in hard copy or microfiche form at a cost-only fee from the following address:

Mrs. Linda Merryman, Project Librarian
Animal Waste Technical Information Center
School of Environmental Science
East Central Oklahoma State University
Ada, Oklahoma 74820

SECTION 2

USER'S GUIDE

The entries in this bibliography have been assigned a specific cross reference code. The code number consists of nine digits (example: 200-76-4625) arranged in the sequences of a three-digit class code, a two-digit number representing the year of publication or presentation, and a four-digit accession number identifying each article brought into the animal waste information collection. The first grouping identifies the class code of the document according to the following format:

Code	Class
100	Technical journal paper
200	Conference proceeding paper
300	University or government publication
400	Magazine article
500	Book or chapter from a book
600	Unpublished paper
700	Thesis

This publication consists of three sections: Author Index, Animal Information Category Index, and Abstracts. An explanation of each section follows.

AUTHOR INDEX

This index lists all the authors cited in the bibliography in alphabetical order. To the right of each author entry is the cross reference code of the article or articles with which he is identified. An example of the format is as follows:

BLAIR R	100 73 4248 100 72 4475 400 73 4488
BLAKE I G	100 77 4161
BLUME R R	100 72 4155 100 70 4285
BODA J O	200 76 4261

ANIMAL INFORMATION CATEGORY INDEX

To provide a quick entry into the abstract holdings of the collection, an animal information code was developed. This code utilizes an alphabetical entry to signify a broad interest area and a numerical digit to designate a more specific topic under the broad interest area. Each abstract in the collection is classified according to this code and could be listed under the most relevant categories. This provides the user with an easy entry into the abstract holdings pertaining to his information needs. An outline of the categories of information may be found on the next page.

CATEGORIES OF ANIMAL INFORMATION

Interest Area	Topic Area
A. Environmental Effects	1. General
	2. Surface Runoff from Animal Production
	3. Surface Runoff from Agricultural Watersheds
	4. Surface Water Pollution
	5. Groundwater Pollution
	6. Odor
	7. Air
	8. Soil Systems
	9. Biocides
	10. Vectors
	11. Animal Health
	12. Public Health
	13. Aesthetics
B. Management of Animal Production and Related Operations	1. General
	2. Liquid Systems
	3. Solid Systems
	4. Storage
	5. Pasture Land and Cropland Management
C. Characteristics of Animal Wastes	1. Physical
	2. Chemical
	3. Biological
D. Treatment Processes	1. Physical
	2. Chemical
	3. Biological
E. Utilization and Disposal	1. General
	2. Land Disposal or Reuse
	3. Recycling
	4. By-Product Recovery
F. General	1. Economics
	2. Legalities
	3. Policy Needs
	4. Overviews

The entries in the Animal Information Category Index appear by accession number under the code number as found in the following example:

C1
4001
4003
4009

ABSTRACTS

This section contains the abstracts of the information entries contained in the bibliography. Many of these abstracts have been published in Selected Water Resources Abstracts published by the Water Resources Scientific Information Center. Each entry includes the title of the informational material, the bibliographic citation, the author or authors, keyword identifiers and descriptors, and the abstract. The abstracts are arranged sequentially by an assigned accession number which specifically identifies the article in the collection.

SECTION 3

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SECTION 5

ABSTRACTS

4000-B1

THE ROLE OF SYSTEMS ANALYSIS IN THE USE OF AGRICULTURAL WASTES

Department of Agricultural Engineering, University of Manitoba, Winnipeg, Manitoba, Canada
D. D. Schulte and E. J. Kroeker
Journal of Environmental Quality, V. 5, No. 3, p. 221-227, July-Sept., 1976. 4 fig., 21 ref.

Keywords: Systems analysis, Agricultural waste management, Multi-Disciplinary approach, Model studies, Simulation analysis, Linear programming, Dynamic programming.

A brief perspective of agricultural waste management and systems analysis is given. It is felt that there is a need for a generalist in agricultural waste management who can bridge disciplinary gaps and promote effective cooperation between specialists in various fields of study. Systems analysis, a scientific approach to planning and design of an organized system, may prove to be a useful tool in achieving integration of the multidisciplinary work which is taking place. To date, applications of systems analysis to agricultural waste management problems have been relatively few and include efforts to: (1) provide a common structure for comparison of agricultural waste management strategies, (2) identify processes or links within waste utilization systems which are costly or sensitive to operating conditions, (3) predict effects of external constraints such as government policy, fertilizer taxes, and prices on the effectiveness of waste utilization strategies, (4) yield information to predict where research funds would be spent most effectively, and (5) assist in technology transfer from researchers to practitioners through the aid of computer-based educational models. (Merryman-East Central)

4001-A3, A4, A5, A6, A8, B2, B5, C1, C2, D3, E2

DESIGN PARAMETERS FOR ANIMAL WASTE TREATMENT SYSTEMS - NITROGEN CONTROL

Department of Agricultural Engineering, Cornell University, Ithaca, New York 14853
R. C. Loehr, T. B. S. Prakasam, E. G. Srinath, T. W. Scott, and T. W. Bateman
Environmental Protection Agency Report No. EPA-600/2-76-190, Sept., 1976, 144 p. 37 fig., 27 tab., 29 ref.

Keywords: Design, Waste treatment, Odor control, Nitrogen control, Feasibility studies, Land application, Liquid wastes, Oxidation ditch mixed liquor, Application rates, Crop response, Water pollution, Groundwater pollution, Agricultural runoff, Aeration, Poultry manure, Corn, Grasses.

The objectives of this study were to: (a) develop design criteria for nitrogen and odor control in animal waste stabilization systems; (b) demonstrate the feasibility of nitrogen control using the oxidation ditch; (c) determine the rate, form, and time of manure application permissible without causing surface or groundwater pollution; and (d) determine the optimum rate, form, and time of application for best crop response. Laboratory, pilot plant, and full scale studies were conducted to develop design parameters for odor and nitrogen control. Information concerning the fate of manurial nitrogen and crop response was derived from agronomic field studies. A method of determining oxygen requirements for stabilization based on exerted carbonaceous and nitrogenous oxygen demand was developed. Controlled nitrogen removal in the range of 30 to 90 percent was demonstrated. Nitrogen losses were due to ammonia volatilization and/or nitrification-denitrification. Field studies indicated no differences between raw and aerobically stabilized poultry manure in nutrient availability to plants or surface runoff losses. At a given rate of manure application, soil nitrate levels were higher under corn in comparison to grasses. The maximum recommended application rate of poultry manure for corn was 224 kg N/ha. Application rates for grasses were limited to 100-170 kg N/ha by plant response. (Loehr-Cornell)

4002-A11, A12, B2, C3, D2, D3

EXPERIMENTAL STUDIES INTO THE EFFECT OF CATTLE MANURE ON *FASCIOLA HEPATICA* EGGS

Sektion Tierproduktion und Veterinarmedizin der Humboldt, Universitat zu Berlin
W. Pietsch and R. Buchwalder
Monatshefte fuer Veterinaer-Medizin, V. 26, No. 19, p. 737-739, Oct., 1971. 1 fig, 2 ref.

Keywords: Liquid wastes, Pathogenic bacteria, Temperature, pH, Sampling, Fermentation, Stagnation, *Fasciola hepatica* eggs, Germany.

Viability and development of *Fasciola hepatica* eggs in liquid cattle manure was studied. The egg samples were kept in manure over 3, 8, and 16 days at temperatures of 0.5 C, 16 C and 22 C, the pH value being about 8.2. Manure accomodation was followed by egg cultivation under optimum conditions. Several experiments were reproduced. While a few eggs only had been killed, the development was inhibited by the liquid manure. Under optimum conditions, 72 percent of all eggs reached the stage of fully developed miracidia, against a value of 85 percent for the control group. The delay in the hatching time increased with extended exposure to manure. A hatching rate of 47 percent was found, against 62 percent in the control group. Reduction in pH value to 7.3 and temperature variations in the range of 0.5 to 22 C had only an unimportant effect. The results were statistically verified by means of Student's t-test. The combined action of liquid manure and oxygen deficiency caused stagnation in the development of the eggs, and the stage of fermentation of the manure played an important role. During cultivation under optimum conditions, a certain acclimatization period, proportional to the manure accommodation, was required for further development. (Text in German) (Solid Waste Information Retrieval System)

4003-A6, A8, B2, C1, C2, C3, D3, E2

DESIGN CRITERIA FOR SWINE WASTE TREATMENT SYSTEMS

Biological and Agricultural Engineering Department, North Carolina State University, Raleigh, NC 27607
F. J. Humenik and M. R. Overcash
Environmental Protection Agency Report EPA-600/2-76-233, Oct., 1976, 292 p. 89 fig., 57 tab., 94 ref.

Keywords: Design criteria, Lagoons, Swine wastes, Waste treatment, Liquid wastes, Aeration, Model studies, Loading rates, Odor, Nitrogen, Irrigation, Land application.

Coordinated laboratory, field pilot-, and farm-scale lagoon studies were conducted to define relationships between loading intensity and frequency based on treatment performance, sludge accumulation, and odor potential. Surface aeration of field pilot units and farm-scale lagoons was also investigated to evaluate aeration levels required for odor control and the effect of surface aeration on nitrogen and organic transformations. Laboratory studies were designed to elucidate basic chemical, physical, and biological mechanisms important in explaining and modeling lagoon performance. Long-term mass balance studies were conducted to define the fate of waste input and thus total constituent loss from the system. Predictive and interpretive relationships for lagoons based on constant batch loading and continuous loading were derived to describe the supernatant concentration of unaerated lagoons. Methods for determining steady-state concentrations and first-order reaction rate constants for oxygen demand, organic carbon, and nitrogen were developed and compared with laboratory and field pilot-scale data. Lagoon liquid from a farm-scale unit was irrigated to nine 9.24 m x 9.24 m Coastal Plain soil-Bermuda grass plots at nitrogen loading rates of 300, 600, and 1,200 kg N/ha. / year. Mass balance data were collected to determine the fate of applied waste constituents. (Humenik-EPA)

4004-D2, E4

CONVERSION OF CATTLE MANURE INTO USEFUL PRODUCTS

UCLA School of Engineering and Applied Science, Los Angeles, California 90024
B. S. Dunn, J. D. Mackenzie, and E. Tseng
Environmental Protection Agency Report EPA-600/2-76-236, Sept., 1976, 33 p. 7 fig., 7 tab., 5 ref.

Keywords: Cattle manure, Byproducts, Pyrolysis, Design, Recycling, Lampblack, Glass foam, Ink, Glass tile, Rubber, Briquettes, Oil, Fertilizer, Paint.

The purpose of the project was to design and build a pyrolysis apparatus for cattle manure and to investigate the potential uses of the pyrolysis by-products. A pyrolysis machine of semi-continuous feed capabilities was designed and built. Various conditions of pyrolysis treatments were investigated and their influence on the amount and composition of the by-products determined. High carbon residues were found to require lower pyrolysis temperatures. The carbon content of these residues appeared to be unaffected by the geographic location of the original manure. Contact with interested parties and appropriate industries who could be prospective users of each of the products was initiated to obtain their technical expertise in evaluating these products. The pyrolysis by-products seem to have some potential industrial applications. These by-products include the solid residue, an oil fraction, and an aqueous fraction. The solid residue may serve as a carbon black substitute or as a filler material in rubber, ink, and paint. The aqueous fraction collected during pyrolysis has been evaluated for fertilizer applications. (Dunn-UCLA) (WRSIC)

4005-A9, A10, D3

BACTERIAL SPRAY ON MANURE INEFFECTIVE IN FLY CONTROL

Anonymous
Poultry Digest, V. 35, No. 417, p. 466, Nov., 1976.

Keywords: Bacterial spray, Fly control, Poultry droppings.

In a field study conducted by W. D. McKeen and W. F. Rooney, University of California farm advisors in San Bernadino County, a bacterial spray was stirred into poultry droppings at various intervals. The effect of such a spray on the control of the little house fly and the coastal fly was studied. Droppings stirred 3 times a week produced the fewest flies, but fly control was not satisfactory. Had the weather been warmer and drier, Mr. McKeen and Mr. Rooney felt that the stirring of the manure 3 times a week would have been more effective. (Merryman-East Central)

4006-A8, B3, B5, C2, C3, D2, D3, E2

PROCESSING SOLID MANURE FROM LIVESTOCK-FARMING TO ORGANIC FERTILIZER FOR VEGETABLE GARDENING

Beitrag aus der Sektion Gartenbau der Humboldt-Universitat zu Berlin, Forschungsbereich Bodenfruchtbarkeit, GroBbeeren
E. Baumann and J. Reinhold
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 199-201, June, 1972. 5 fig.

Keywords: Solid wastes, Fertilizers, Nutrients, Nitrogen, Hot drying, Composting, Phosphorus, Potassium, Crop response, Aerobic fermentation, Poultry manure, Urea-formaldehyde foam, Dried pine bark, Germany.

The processing of solid manure from livestock-farming to organic fertilizer, and the use of such fertilizer in vegetable gardening are described. Hot drying, associated with a nutrient loss of about 10 percent, and composting are suitable for the conversion of solid manure into germ- and weed-seed-free organic fertilizer fit for use in vegetable gardening. Composting is a continuous process to be conducted over at least 5 days, where the temperature should exceed 50 to 70 C during the aerobic fermentation. Fermentation experiments with poultry manure to which urea-formaldehyde foam and dried pine bark were added in combined proportion of 2:1 revealed nutrient losses of 30 to 40 percent during fermentaton. Unlike pine bark, urea-formaldehyde foam had beneficial effect on the nutrient output. Intensified composting resulted in increased nitrogen losses. The organic fertilizer thus obtained should be mixed with 90 percent of peat for fertilization. The effect of such fertilizers on plants is largely dependent on the amount of water-soluble nitrates. Poultry manure processed with equal amounts of urea-formaldehyde foam yielded better crops than fresh poultry manure. (Text in German) (Solid Waste Information Retrieval System)

4007-A5, A8, B2, B5, C2, C3, E2

WATER MANAGEMENT ASPECTS OF THE AGRICULTURAL UTILIZATION OF LIQUID MANURE AND PRELIMINARY EXPENDITURE STANDARDS

Arbeit aus dem Institut fur Wasserwirtschaft, Berlin
W. Kruger and W. Hirte
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 201-204, June, 1972. 6 fig, 1 tab.

Keywords: Groundwater pollution, Liquid wastes, Leaching, Bacteria, Nitrates, Phosphates, Field spreading, Separation techniques, Cattle, Germany.

Field and laboratory tests on the possible contamination of the groundwater with liquid manure in farmlands are described, and recommendations of the intensity of the use of liquid manure are derived. The germ count in liquid manure may be up to 10 times that in domestic effluent. The reduced germ count in the liquid phase of liquid manure following phase separation indicates that the bulk of the germs is absorbed by solid organic particles. Correlation between the nitrate content of the leachate and the liquid manure expenditure, especially at per-hectare expenditures corresponding to the manure production by 8 or more steers, was established. The intensity of the use of liquid manure had, however, no effect on the phosphate content of the leachate. The contamination of the leachate is dependent on the nutrient extraction by the plant, thus on the time when the liquid manure is applied, and on the soil type. Hygienic and bacteriological investigations revealed that infections of soil layers deeper than 60 cm with coliform bacteria are exceptional when manure produced by maximum of 8 steers is used per hectare. When the manure from at least 4 steers is used per hectare, it should be applied in fractionated doses over an extended period of time. The use of large amounts of liquid manure at one time may cause serious groundwater contamination, especially during the winter period. (Text in German) (Solid Waste Information Retrieval System)

4008-B2, D1, D2, D3, F1

SOME POSSIBILITIES AND ASPECTS OF THE CHEMICAL AND BIOLOGICAL TREATMENT OF LIQUID MANURE

Beitrag aus dem Institut fur Wasserwirtschaft, Berlin
W. Otto
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 193-196, June, 1972. 2 tab, 6 ref.

Keywords: Physical treatment, Chemical treatment, Biological treatment, Liquid wastes, Anaerobic conditions, Aerobic conditions, Lagoons, Economics, Coagulation, Flocculation, Dehydration, Hydrochloric acid, Agitation, Electrochemical treatment, Settling basin, Germany.

Possibilities of the physical, chemical, and biological treatment of liquid manure are reviewed. The anaerobic partial decomposition and evaporation to a thick residue in the lagoon involves problems in terms of hygiene and possible water pollution. A combined physical and chemical treatment process uses a vibrator with 140 micron-mesh for reducing by 85 percent the concentration of settling matter. The liquid phase is then treated with hydrochloric acid to obtain both a pH value of 6.50 and partial coagulation, followed by electro-chemical reactions which result in a pH value of 9.0 and more coagulations. Secondary electrochemical treatment with agitation and neutralization is done in a settling basin, and the effluent leaving this stage is further treated in a two-stage aeration basin for discharge into the recipient. The sludges from the different treatment stages are mixed, treated with flocculating agents, and dehydrated in vacuum filter and filter press. Though this process has high efficiency, with a residual BOD-content of 33 mg per liter, it is also expensive. Evaporation with subsequent incineration is not feasible due to the high energy costs and to possible nitrogen oxides emissions, while the flameless incineration of the organic matter in liquid medium in a temperature range of 100 to 372 C without energy supply is, though requiring complicated and expensive technique, profitable for liquid manure with calorific values higher than 100 kcal per liter. Liquid manures with calorific values above 500 kcal per liter may even generate steam. Aerobic biological treatment in low-intensity oxidizing basins has high efficiency provided auxiliary oxygen and agitation are applied. Short-term, high-intensity treatment is best in several stages with sludge recycling. High-intensity reactors, though expensive, are suitable for the rapid treatment of liquid manure at high temperature with efficiencies of 70 to 80 percent. (Text in German) (Solid Waste Information Retrieval System)

4009-A6, B2, B4, C1, C2, C3, D3, E2, E3

CONTRIBUTION TO THE TREATMENT OF LIQUID MANURE IN NATURAL-BIOLOGICAL LAGOON SYSTEMS

Beitrag aus dem Hygiene-Institut des Bezirks Rostock in Greifswald und der Sektion Landeskultur des BfB Neubrandenburg
W. Schwarz and G. P. Schmidt
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 191-193, June, 1972. 2 fig, 1 tab, 3 ref.

Keywords: Liquid wastes, Biological treatment, Lagoons, Sedimentation, Waste storage, Biochemical oxygen demand, Bacteria, Irrigation, Deodorization, Germany.

The efficiency of the treatment of liquid manure in lagoon systems for sedimentation of suspended matter, and for partial biological decomposition and deodorization was studied. The extent of the decomposition of the liquid manure, containing only bacteria and heterotrophic and autotrophic flagellates, was relatively limited after lagoon storage over several months. The BOD decreased from 2,800 to 2,200 mg per liter and from 3,800 to 2,900 mg per liter in two different cases. Correlation between the BOD contents and the volume of the biomass was revealed as a possibility. While extended storage time was found to be insufficient for a substantial enhancement of the decomposition, subsequent aeration resulted in increased rate of decomposition. An attempt to recycle lagoon-treated liquid manure for flushing stables proved to be successful in terms of reduced water consumption and pretreating fresh liquid manure. Liquid manure diluted with water is best used for irrigation of farmlands. (Text in German) (Solid Waste Information Retrieval System)

4010-A4, A6, B2, C1, C2, C3, D1, D2, D3

POSSIBLE TREATMENT METHODS FOR LIQUID MANURE FOR THE MODIFICATION OF ITS PHYSICAL, CHEMICAL AND HYGIENIC PROPERTIES AS A BASIS OF ITS USE IN AGRICULTURE

Institut fur Mineraldungung Leipzig der AL der DDR, Zweigstelle Potsdam
P. Wedekind and D. Suessenbach
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 184-189, June, 1972. 8 fig., 5 tab., 20 ref.

Keywords: Liquid wastes, Waste treatment, Physical properties, Chemical properties, Hygienic properties, Deodorization, Separation techniques, Nitrogen, Phosphorus, Potassium, Trace elements, Pathogenic bacteria, Sedimentation, Viscosity, Centrifugation, Coagulation, Germany, Physical treatment, Chemical treatment, Biological treatment.

General problems of the conditioning of liquid manure for agricultural use are reviewed. Liquid manure constitutes a polydisperse suspension with high contents of organic matter, nitrogen, phosphorus, potassium and of certain trace elements. Pipelines are readily plugged by liquid manure due to sedimentation and flotation. The rate of gas formation, highest between the 7th and 10th days, lies at about 300 liters per kg of organic matter. The viscosity is largely determined by the proportion of the 0.1 to 0.000001 mm-fraction, which, when high, may give thixotropic properties to the liquid manure. The exceptionally high electrolyte concentration favors the killing of germs, which again is a function of the temperature. Liquid manure represents water pollution hazard due to its high BOD of 5,000 to 40,000 mg per liter. The conventional method of liquid manure application (collection, and distribution from tanks) requires a minimal dry content of 7 to 8 percent. Though the concentrations of odorous matter, pathogenic germs and parasites decrease in this form of application, odorous emissions are a problem. Solid-liquid separation by means of centrifugation yields a centrifugate with an odor intensity reduced by 30 to 40 percent, a lower viscosity, and maximum nitrogen, phosphorus, potassium and dry contents of 0.5, 0.06, 0.3 and 4 percent, as well as a coarse fraction high in pathogens. Settling in settling tanks is applied in some cases, while natural dehydration is unacceptable for hygienic reasons. Thermal separation, although it kills germs, does not eliminate odors, and requires much energy, so that it is applicable to valuable poultry-yard manure at best. Diluted liquid manure with a dry content of 0.5 percent and BOD of less than 6,000 mg per liter is suitable for aerobic biological treatment with BOD values reduced to or below 200 mg per liter as a result. Near-complete coagulation and partial odor control is possible by aluminum or iron sulfate as flocculating agents, added in amounts of 0.1 to 1 percent by weight. Deodorization by means of such agents as peroxyacetic acid, chlorine, lime, potassium permanganate, ozone, phosphoric acid, superphosphate, lime, activated carbon or Wofatit is not feasible due to the high concentrations in the liquid manure of oxidizable, buffering and absorbing matter. (Text in German) (Solid Waste Information Retrieval System)

4011-B2, B5, E2

EXPERIENCES WITH THE COMBINED LIQUID MANURE-CLEAR WATER IRRIGATION

Institut fur Mineraldungung Leipzig der Al, Zweigstelle Potsdam
J. Gellrich
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 208-209, June, 1972. 5 tab, 1 ref.

Keywords: Liquid wastes, Irrigation, Land spreading, Equipment, Germany.

General problems of the combined liquid manure-water irrigation of farmlands are reviewed. The combined irrigation process, requiring homogenized liquid manure with no coarse particles, is feasible on a year-round basis with a lower temperature limit of minus 10 C. Irrigation facilities for the combined application of liquid manure and water should be suitable for the simultaneous and seperate use of manure-water mixtures and water alike. Liquid manure and water should be combined in nearly equal proportions for irrigations during the winer period, while mixtures for irrigation during the vegetation period may contain up to 10 parts of water per one part of liquid manure. The dosaging of the liquid manure is dependent on the specific needs of the crops irrigated. Mixing and dosaging on the suction side should be applied for irrigation during the vegetation period, but no hardware for mixing on the delivery side is yet available. (Text in German) (Solid Waste Information Retrieval System)

4012-A4, B2, C2, D1, D2, D3, E2, F1

WATER MANAGEMENT PROBLEMS INVOLVED IN THE TREATMENT AND UTILIZATION OF LIQUID MANURE

Arbeit aus dem Institut fur Wasserwirtschaft, Berlin
D. Kramer
Wasserwirtschaft-Wassertechnik, V. 22, No. 6, p. 182-184, June, 1972. 4 fig, 6 ref.

Keywords: Waste treatment, Waste disposal, Liquid wastes, Water pollution, Land spreading, Nitrogen, Phosphorus, Economics, Separation techniques, Activated sludge, Germany.

General problems of the treatment and disposal of liquid manure in East Germany are discussed. Liquid manure constitutes a real problem in terms of water pollution due to its high BOD value (4,000 to 7,000 mg per liter), and its high nitrogen and phosphorus contents. While the use of organic fertilizer has been in steady decrease for decades, the application of liquid manure to farmlands represents the best solution in terms of economics and environmental protection. Laboratory tests adopting the activated sludge method for the treatment of liquid manure gave largely satisfactory results in one-stage operation, with no significant improvement in two-stage process. However, dilution of the liquid manure at a ratio of 25 or more, and phase separation with separate treatment of the sludge obtained were necessary. Increasing fish death during the last decade due to agricultural organic effluents has occurred. (Text in German) (Solid Waste Information Retrieval System)

4013-A11, C2, D1, D2, E3

CHARACTERISTICS OF SORGHUM GRAIN RECONSTITUTED WITH EXCREMENT FROM FEEDLOT CATTLE

Department of Animal Science, Texas A & M University, College Station, Texas
L. M. Schake, C. E. Donnell and R. E. Lichtenwalner
Paper to be published in the 1974 Beef Cattle Research in Texas publication, Department of Animal Science, Texas A & M University, 6 p. 5 tab. 5 ref.

Keywords: Feeds, Sorghum, Feedlots, Confinement pens, Cattle, Performance, Diets, Nutrients, Reconstituted feeds.

Seven grain processing techniques were studied. Three, which served as controls were: (1) dry ground grain, (2) steam flaked grain fed air-dry, and (3) water reconstituted grain ground before each feeding. Four additional reconstituted grain treatments were formed when feedlot excrement with 16 percent dry matter from slotted floor confinement pens was combined with whole sorghum grain at ratios of 1:1, 1:1.6, 1:1.25, and 1:3.1. The experimental rations contained considerably higher levels of crude protein, crude fat, phosphorus and salt than the 3 control rations. Heifers refused to consume a feed mixture in which the 1:1 product constituted 80 percent of the 1:1.6, 1:2.5, and 1:3.1 products. Reconstituted grain treatments utilizing excrement appear to be a potentially useful feed for cattle if the excrement:grain ratio does not exceed 1:1.6. (Merryman-East Central)

4014-A11, C1, C2, E3, F1

EXCREMENT RECONSTITUTED GRAIN FOR GROWING AND FINISHING CATTLE

Department of Animal Science, Texas A&M University, College Station, Texas 77843
L. M. Schake
Calf News, V. 15, No. 2, p. 34-35, Feb., 1977. 3 fig., 4 tab.

Keywords: Refeeding, Economics, Cattle manure, Reconstituted grain, Rations, Performance, Taste, Crude protein, Fat, Crude fibers, Ash.

The $12 to $20 per head feed savings demonstrated by the water reconstitution of a dry grain sorghum has caused many investigators to examine another type of reconstitution media. One such product was excrement, an accumulation of feces, urine, hair, and other materials, from the pits of slotted floor confinement barns in which cattle finished for slaughter were housed. This material was found to contain about 15 percent dry matter of which 21 percent was crude protein, 7 percent fat, 22 percent crude fibers and 1.8 percent ash. In experiments completed at Texas Agricultural Experiment Station, known quantities of grain and fresh excrement were combined in various ratios to determine cattle response to rations containing 80 percent of the excrement reconstituted grain. It was indicated that less than a 1:1 ratio excrement to grain would be consumed at normal levels. In feeding experiments, 73 percent air dry grain was combined with 27 percent excrement. Excrement reconstituted grain improved feeding response 4 percent and weight gain was increased over 7 percent when compared to water reconstituted grain. Taste panel scores showed no significant change from control carcasses, as was true of 14 other measures of carcass value. Excrement reconstituted grain sorghum was shown to be equal or slightly superior to water reconstituted grain in feeding cattle. Four percent excrement dry matter can be refed with the grain in a process that requires minimum energy inputs. (Keel-East Central)

4015-B2, D3, F4

LAGOONS AND OXIDATION PONDS

University of Kansas, Lawrence, Kansas 66044
C. E. Burkhead and W. J. O'Brien
Journal of the Water Pollution Control Federation, V. 46, No. 6, p. 1135-1137, June, 1974. 5 ref.

Keywords: Literature survey, Lagoons, Livestock wastes, Dairy wastes, Kraft pulping wastes, Aerobic conditions, Anaerobic conditions, Effluents, Algae removal, Stockyards.

A survey of research reports and other literature available in the field of lagoons and oxidation ponds is presented. There have been a few comprehensive reviews of lagoon systems. Several authors have discussed the use of lagoon systems to handle particular types of wastes, including livestock wastes, kraft pulping wastes, and dairy wastes. The use of aerobic lagoons, anaerobic lagoons, and combined lagoon systems for the treatment of various wastes has been investigated in many studies. Considerable emphasis has been placed on algae removal from oxidation pond effluents. Oxidation ponds have been found to be effective for treating the liquid wastes from stockyards and for recycling treated waste waters and storm water runoff from manufacturing operations. (Solid Waste Information Retrieval System)

4016-A4, A5, A8, B2, B3, B4, B5, C2, E2

DAIRY MANURE CAN BE USED SAFELY

J. L. Meyer, R. S. Rauschkolb, and E. H. Olson
California Agriculture, V. 30, No. 11, p. 10-11, Nov., 1976. 1 fig.

Keywords: Dairy manure, Waste management, Waste storage, Water pollution, Groundwater pollution, Salts, Nutrients, Land application, Leaching, Nitrogen release, Liquid wastes, Solid wastes.

University of California research has established that potential environmental problems in fertilizing croplands with dairy manure can be avoided with proper management. Recent University of California research has shown: (1) the kinds and amounts of salts and plant nutrients in dairy manure, (2) what happens to salts and plant nutrients during storage in manure piles and manure storage ponds, and (3) the amount of salts seeping downward below the soil surface in fields heavily treated with manure. In a continuous cropping system, providing enough nitrogen for satisfactory yield without excessively concentrating salts (which may pollute groundwater and surface waters) depends upon: methods of handling, storing, and applying manure; rate of application and the amount and rate of nitrogen release in the soil. Taking these factors into account, different management systems are used for dry manure and holding pond manure. For dry manure, once the nitrogen percentage is established (either through laboratory analysis or through an assumed percentage), average expected rates of nitrogen release - called ''decay series''- may be used to determine what annual applications are needed to release the nitrogen to the soil on a year to year basis. The ''decay series'' means that, with continued annual applications to the same land, a smaller amount of added manure is needed each year to provide the same amount of available nitrogen in the soil. For liquid manure, equations are given for calculating the amount of manure in storage and the number of acres on which one pondful of liquid manure can be spread each year. (Merryman-East Central)

4017-A4, B2, B4

PERFORMANCE OF FEEDLOT RUNOFF CONTROL SYSTEMS IN NORTHERN CLIMATES

Agricultural Engineering Department, University of Minnesota, St. Paul, Minnesota
C. L. Larson, L. G. James, P. R. Goodrich, and J. Bosch
Transactions of the ASAE, V. 19, No. 6, p. 1175-1180, Nov.-Dec., 1976. 1 fig., 5 tab., 9 ref.

Keywords: Mathematical models, Model studies, Minnesota, Feedlots, Agricultural runoff, Design, Water pollution, Runoff control, Holding ponds.

In 1973, a model study was initiated by the EPA in cooperation with the Minnesota Pollution Control agency to examine the performance of feedlot runoff control systems in the northern climates. Runoff control facilities are often needed to intercept and store surface runoff from outside lots so that nutrients, organic material and sediments can be recycled to the land instead of being carried into public water supplies. Maximum runoff rates from feedlots or other small areas are generated by high intensity storms of short duration. For Minnesota and other areas having similar climatic conditions, the following conclusions were recorded as a result of the study. A series of rainstorms occurring within a period of five to ten days can frequently cause holding pond overflow. Land disposal of the stored runoff is seldom possible. Holding pond outflow will occur more frequently than indicated by the recurrence interval of a 24 hour rainstorm. The holding pond capacity must be made greater than the one day runoff in order to obtain an overflow frequency about the same as that of the design storm. The amount of both holding pond outflow and pumping for land disposal can be reduced by enlarging holding pond beyond minimum capacity. The reduction will also depend on the operating rules for starting and stopping the pumping operation. (Keel-East Central)

4018-A11, B2, C1, C2, D3

EFFECT OF DIETARY SALT LEVEL AND LIQUID HANDLING SYSTEMS ON SWINE WASTE COMPOSITION

Purdue University, West Lafayette, Indiana 47907
A. L. Sutton, V. B. Mayrose, J. C. Nye, and D. W. Nelson
Journal of Animal Science, V. 43, No. 6, p. 1129-1134, Dec., 1976. 4 tab., 29 ref.

Keywords: Diets, Salts, Liquid wastes, Swine wastes, Performance, Chemical properties, Physical properties, Oxidation ditch, Deep pit, Waste management, Aerobic conditions, Anaerobic conditions, Nutrients, Nitrogen, Potassium, Phosphorus, Copper.

A 2-year experiment was conducted to study the effects of .2 or .5 percent salt (NaCl) in growing-finishing swine diets and aerobic (oxidation ditch) or anaerobic (deep pit) liquid waste systems on swine performance and waste nutrient composition. Neither dietary salt content nor waste handling system affected pig gains or feed conversion. Waste from pigs fed .5 percent salt contained higher sodium levels than waste from pigs fed .2 percent salt. During the study, the sodium level increased in the waste pits beneath pigs fed the .5 percent salt diet, whereas the sodium level in the waste pits beneath pigs fed the .2 percent salt diet remained relatively constant. Aerobically treated waste contained lower dry matter and higher dissolved oxygen concentrations, had higher pH and temperature on a wet basis, and lower ammonium nitrogen and higher nitrate nitrogen, potassium and sodium concentrations on a dry weight basis than anaerobic waste. The average percentage of ammonium nitrogen to total Kjeldahl nitrogen was 42 percent in aerobic pits, 53 percent in anaerobic pits, 45.5 percent in waste from pigs fed .5 percent salt diets and 49.5 percent in waste from pigs fed .2 percent salt diets. Copper and phosphorus levels in wastes were directly related to the dry matter content of the waste. Sodium and potassium concentrations (dry weight basis) were higher in aerobically treated waste from pigs fed the .5 percent salt diet compared to anaerobically treated waste from pigs fed the .2 percent salt diet. (Copyright 1976-Journal of Animal Science)

4019-A11, B3, C2, E3, F1

ALFALFA VERSUS POULTRY EXCRETA AS NITROGEN SUPPLEMENTS FOR LAMBS

Feed Energy Conservation Laboratory, Animal Physiology and Genetics Institute, Beltsville Agricultural Research Center, Beltsville, Maryland 20705
L. W. Smith and I. L. Lindahl
Journal of Animal Science, V. 44, No. 1, p. 152-157, Jan., 1977. 5 tab., 12 ref.

Keywords: Refeeding, Dehydrated poultry excreta, Diets, Sheep, Performance, Economics, Alfalfa, Nitrogen, Crude protein, Ash.

Dehydrated excreta from caged layers (DPE) was compared with alfalfa as a nitrogen supplement for lambs at both 8 and 12 percent dietary crude protein levels. All diets contained a calculated 65 percent TDN content, and the supplements contributed 36 to 40 percent (8 percent crude protein diets) or 60 to 65 percent (12 percent crude protein diets) or the total dietary nitrogen. Lambs digested dietary nutrients from the two sources of nitrogen equally well, except that ash was 43 percent less digestible in DPE supplemented diets. Lambs fed the 12 percent crude protein diets consumed 22 percent more feed (P is less than .10), gained 74 percent faster (P is less than 0.5), and were 39 percent more efficient (P is less than .05) in converting gross digestible organic matter into gain than lambs fed the 8 percent crude protein diets. Lambs fed diets supplemented with DPE tended to consume more feed and convert digestible organic matter available for growth 32 percent more efficiently than lambs fed diets supplemented with alfalfa, but differences were not significant (P is greater than .10). Cost of grain for lambs fed the 12 percent CP diet supplemented with DPE was 17 percent lower than for lambs fed the 12 percent CP diet supplemented with alfalfa. (Copyright 1977-Journal of Animal Science)

4020-A11, B3, C2, E3

DEHYDRATED BROILER EXCRETA VERSUS SOYBEAN MEAL AS NITROGEN SUPPLEMENTS FOR SHEEP

Animal Physiology and Genetics Institute, Beltsville, Maryland 20705
L. W. Smith and C. C. Calvert
Journal of Animal Science, V. 43, No. 6, p. 1286-1292, Dec., 1976. 1 fig., 7 tab., 23 ref.

Keywords: Refeeding, Dehydrated broiler excreta, Soybean meal, Diets, Performance, Nitrogen, Arsenic, Digestibility.

Diets supplemented with dehydrated broiler excreta (DBE) were consumed by sheep as readily as diets supplemented with soybean meal. Diets supplemented with either soybean meal or DBE did not significantly differ in digestibility or nitrogen (N) retention. The true digestibility of DBE-N was 81 percent, a value of similar magnitude determined by others for dry-mixed conventional feeds. Feeding the DBE resulted in low levels of arsenical residues in the lamb tissue. Significance of arsenic in poultry manure processed for ruminant crude protein supplements will depend on individual feeding regimes, arsenic concentration in excreta, and permissible levels established for lamb and mutton. (Copyright 1976-Journal of Animal Science)

4021-A2, B1, E3, F1

ENERGY POTENTIAL FROM WASTE SMALL

Anonymous
Beef, V. 13, No. 7, p. 12, March, 1977.

Keywords: Energy, Open feedlots, Animal wastes, Recycling, Agricultural runoff, Economics.

The possibility of obtaining energy economically from feedlots appears impractical. The energy value of animal wastes from open feedlots is reduced by bacterial action, feedlot runoff, and mixing of soil and water with the waste so that it takes as much energy to collect and process the wastes as can be obtained from the source. Lawrence Schmid, Kansas State University engineer, conducted the research and said that an alternative system of total confinement with continuous fresh manure collection, under certain conditions, could be economically advantageous to use the wastes to energy production. (Bates-East Central)

4022-A11, B1

PERFORMANCE AND ENERGY METABOLISM OF STEERS FED A CONCENTRATE OR ROUGHAGE DIET IN CONVENTIONAL, SEMI-ENCLOSED SLATTED AND ENCLOSED SLATTED FLOOR FEEDLOTS IN SUMMER

Departments of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada
W. S. Alhassan, J. G. Buchanan-Smith, T. D. Burgess, G. C. Ashton, and G. C. Smith
Canadian Journal of Animal Science, V. 55, No. 4, p. 683-695, Dec., 1975. 1 fig., 7 tab., 26 ref.

Keywords: Diets, Housing, Performance, Cattle, Summer, Energy metabolism, Carcass Composition, Serum-iodothyronine, Weight gain, Temperature, Humidity.

One hundred and forty-four steers of predominantly Angus breeding were used to compare the effects of three housing units (conventional semi-enclosed manure pack, semi-enclosed slatted floor and enclosed-insulated slatted floor) and two diets (high moisture corn and corn silage) on the performance, energy metabolism and carcass composition of steers finished for 88 days in the summer. No diet X housing unit interaction on response criteria was observed. The mean temperature in the enclosed unit (24.6C) was more than 3C greater than in other units. Mean relative humidities in each slatted floor unit were 74 percent whereas it was 70 percent in the conventional unit. The enclosed-insulated unit may have been insufficiently ventilated. Steers in this unit ate less (P 0.05) dry matter per day (6.78kg) than those in the semi-enclosed slatted floor unit (7.64 kg) and in the conventional unit (7.66 kg). Different effects of housing unit on gain reflected differences in feed intake. Carcass characteristics of cattle from each housing unit were similar (P 0.05). Efficiency of utilization of metabolizable energy (ME) for maintenance and gain expressed as energy retention (ER) adjusted to equal ME intake was greater (P 0.05) for cattle in the semi-enclosed slatted floor unit (5.17 Meal/day) than in the insulated-enclosed unit (4.36 Meal/day). ER adjusted to equal ME intake for steers in the conventional unit was 4.76 Meals/day. Serum tetra-iodothyronine (T4) levels were similar (P 0.05) for cattle in all housing units, but were depressed in all cattle during a period of the warmest weather. Corn-fed steers ate significantly less dry matter and had significantly greater gain and feed efficiency than silage-fed steers. Backfat thickness was greater (P 0.05) for corn-fed versus silage-fed steers but this difference disappeared when values were adjusted to equal carcass weight. (1975 Copyright-Canadian Journal of Animal Science)

4023-A5, B1, C3

EVALUATION OF PORCELAIN CUP SOIL WATER SAMPLERS FOR BACTERIOLOGICAL SAMPLING

Department of Microbiology, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida 32611
F. B. Dazzo and D. F. Rothwell
Applied Microbiology, V. 27, p. 1172-1174, June, 1974. 1 fig., 7 ref.

Keywords: Sampling, Soil water, Fecal coliforms, Manure slurry, Analysis.

The validity of obtaining soil water for fecal coliform analyses by porcelain cup soil water samplers was examined. Numbers from samples of manure slurry drawn through porcelain cups were reduced 100- to 10,000,000-fold compared to numbers obtained from the external manure slurry, and 65 percent of the cups yielded coliform-free samples. Fecal coliforms absorbed to cups apparently were released, thus influencing the counts of subsequent samples. Fecal coliforms persisted in soil water samplers buried in soil and thus could significantly influence the coliform counts of water samples obtained a month later. These studies indicate that porcelain cup soil water samplers do not yield valid water samples for fecal coliform analyses. (Copyright 1974-Applied Microbiology)

4024-A3, A8, B2, C1, C2, E2

THE EFFECTS OF MANURE APPLICATIONS ON RUNOFF, EROSION AND NITRATE LOSSES

Agricultural Engineering Department, University of Illinois, Urbana, Illinois
J. K. Mitchell and R. W. Gunther
Transactions of the ASAE, V. 19, No. 6, p. 1104-1106, Nov.-Dec., 1976. 2 tab.

Keywords: Land application, Agricultural runoff, Erosion, Liquid wastes, Swine manure, Percolate, Slopes, Total solids, Volatile solids, Chemical oxygen demand.

In a laboratory study at the University of Illinois, liquid swine manure was applied to 0.91 m square plots of Catlin Silt Loam soil, followed by 76.2 mm/hr artificial rainfall for ½ hour. Soil slopes of 3 percent and 9 percent and three manure application levels (0, 9.5, and 19.0 mm depth) were investigated. Runoff and percolate were analyzed to determine the effect of liquid manure application on runoff and erosion characteristics. It was found that manure application to the soil caused a decrease in runoff and an increase in the volume of percolate and the nitrate concentration in the percolate. Manure application also caused a decrease in the total solids concentration and COD load in the runoff. The decrease in solids concentration was probably due to a surface stabilizing effect of the manure on the soil surface. It was found that the loss of the manure solids could be separated from the soil solids loss by using the volatile solids to total solids ratio. (Keel-East Central)

4025-A2, A8, B2, E2

ENGINEER SOUNDS WARNING ON USE OF LAGOON WASTE ON FIELD CROPS

Anonymous
Beef, V. 8, p. 15, April, 1972.
Keywords: Land application, Crop response, Agricultural runoff, Liquid wastes, Lagoon wastes, Effluents.

University of Nebraska expert, Conrad Gilbertson, warns that reuse of liquid runoff from a lagoon may be beneficial to the crop or it may kill the crop entirely. In 1969, effluent from the University's experimental feedlot was sprinkled onto a newly grassed area. The grass was killed by the effluent. In 1970 the experiment was repeated. This time a plot received over ten inches of runoff material produced three times as much grass as the plots that received an identical amount of creek water. Greenhouse studies have turned in the same results. The cause of the variation is not known; therefore, if you do plan to use lagoon waste on field crops, apply it to a very small area to determine the effects it may have on the crops. (Keel-East Central)

4026-A11, B2, C1, C2, C3, D1, D3, E3

RECYCLED EXCRETA AS A NUTRIENT SOURCE FOR SWINE

B. G. Harmon
Presented at Texas A&M University Nutrition Conference, College Station, Oct. 1, 1975, 12 p. 4 tab., 18 ref.

Keywords: Literature review, Oxidation ditch mixed liquor, Refeeding, Swine wastes, Swine, Nutrients, Performance, Physical properties, Chemical properties, Biological properties, Biological treatment, Physical treatment.

A feeding program that includes biologically enhanced swine excreta has advanced from a hypothesis based on chemical analysis to an accepted practice on a few swine farms. A literature review verifies this statement. Diggs et al (1965) demonstrated that swine waste could be scraped from a feeding floor, dried, and substituted into swine rations at 15 percent of the diet without depressing performance. Orr et al (1973) and Harmon et al (1972) revealed that wastes have even greater nutritional quality after bacterial fermentation in an oxidation ditch. Holmes et al demonstrated by screening the contents of an oxidation ditch that the percent dry matter and protein of the dry matter increased as the size openings in the sieves decreased. Analysis of the various fractions (Harmon 1972) showed that amino acids increased significantly as the particle size decreased. The fractions containing microbial cells had the greatest concentration of protein and amino acids. Studies have revealed that over-aeration of an oxidation ditch can cause nitrates to increase to a toxic level. However, most studies seem to indicate that refeeding biologically enhanced swine waste allows the producer to increase the utilization of the components of the diet while virtually eliminating the environmental pollution hazards associated with livestock feeding. (Rowe-East Central)

4027-A11, B2, C2, D3, E3

BIRD PERFORMANCE NOT HURT BY REFEEDING AERATED WASTES

Anonymous
Feedstuffs, V. 49, No. 4, p. 43, Jan. 24, 1977.

Keywords: Refeeding, Oxidation ditch mixed liquor, Liquid wastes, Poultry, Performance, Mortality, Coccidiosis, Nutrients, Phosphorus.

A study was done at Cornell University using 2 groups of 38-week-old hens: (1) a control group receiving drinking water and (2) an experimental group receiving oxidation ditch mixed liquor instead of drinking water. Performance seemed to be much the same for both groups. Of the 2 groups, the experimental group consumed the most liquid--probably due to the salt content of the liquor. Over-all egg production was 2 percent higher for the experimental group. Eggs from the 2 groups showed no significant differences in weight or shell strength. Total mortality for the 2 groups was about the same, although the experimental group did have 2 hens die of coccidiosis of the cecum. However, coccidiosis is easily controlled through the use of coccidiostats as feed additives. Additional information concerning aeration system operation to enhance microbial protein synthesis, as well as the availability of phosphorus to the hen, is necessary before the true potential of this practice can be determined fully. The question of disease transmission also requires further study. (Merryman-East Central)

4028-B2, C2, D3, F1
TERTIARY TREATMENT AND REUSE OF ANIMAL WASTES

Agricultural Engineering Department, University of Delaware, Newark, Delaware 19711
W. F. Ritter
Project Report, OWRT Project No. A-030-DEL, 1976, 36 p. 1 fig., 17 tab., 18 ref.

Keywords: Tertiary treatment, Dairy wastes, Liquid wastes, Biological treatment, Barriered landscape water renovation systems, Economics, Nitrogen, Chemical oxygen demand, Zinc, Aluminum, Phosphorus, Potassium, Sodium.

Liquid dairy waste was applied to two barriered landscape water renovation systems (BLWRS) which were operated for nearly two years. The first BLWRS (1) utilized a silt loam soil, and the second BLWRS (2) utilized a sandy loam soil. Loading rates of 0.84 cm/day were applied to BLWRS-1 and 0.84-2.45 cm/day to BLWRS-2. Because of ponding on the BLWRS surface, the high loading rate of 2.45 cm/day was only maintained for 47 days. Treatment efficiency did not change with loading rates, and there was no significant change in effluent quality during the different seasons of the year. Besides removing significant amounts of zinc, aluminum, COD, nitrogen, phosphorus, potassium, and sodium, it was revealed that a BLWRS cannot be operated for an entire winter in the Mid-Atlantic states. The waste handling system using a BLWRS was estimated to be more expensive than four other systems. The greatest potential for using a BLWRS in the livestock industry would probably be with milking center wastes. (Keel-East Central)

4029-A3, A4, A9, B1, B5, C2, E2, F1
CONTROL OF WATER POLLUTION FROM CROPLAND: VOLUME I -- A MANUAL FOR GUIDELINE DEVELOPMENT

Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C.
B. A. Stewart, D. A. Woolhiser, W. H. Wischmeier, J. H. Caro, and M. H. Frere
Control of Water Pollution from Cropland: Volume I -- A Manual for Guideline Development, prepared as a joint publication of Office of Research and Development, EPA, and Agricultural Research Service, USDA, Nov., 1975, 111 p. 41 fig., 24 tab.

Keywords: Agricultural runoff, Water pollution, Pollution control, Manuals, Erosion, Percolation, Location, Fertilizers, Nutrients, Pesticides, Economics, Livestock wastes, Poultry wastes, Croplands, Rangelands.

Engineering and agronomic techniques to control sediment, nutrient, and pesticide losses from cropland were identified, described and evaluated. Methodology was developed to enable a user to identify the potential sources of pollutants, select a list of appropriate demonstrated controls, and perform economic analyses for final selection of controls. The information is presented in the form of regional maps, decision flow charts, tables, and brief technical highlights. (Stewart-ARS)

4030-A3, A4, B1, B5, C2, E2, F1, F4
CONTROL OF WATER POLLUTION FROM CROPLAND: VOLUME II -- AN OVERVIEW

Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C. 20250
B. A. Stewart, S. A. Woolhiser, W. H. Hischmeir, J. H. Caro, and M. H. Frere
Control of Water Pollution from Cropland: Volume II -- An Overview, prepared as a joint publication of Office of Research and Development, EPA, and Agricultural Research Service, USDA. June, 1976, 187 p. 51 fig., 35 tab., 612 ref.

Keywords: Agricultural runoff, Water pollution, Cropland management, Sedimentation, Erosion, Nutrients, Pesticides, Economics, Pollutant source identification, Pollution control, Overviews.

Engineering and agronomic techniques to control sediment, nutrient, and pesticide losses from cropland are identified, described, and evaluated. Methodology is developed to enable a user to identify the potential sources of pollutants, select a list of appropriate demonstrated controls, and perform economic analyses for final selection of controls. The basic principles on which control of specific pollutants is founded are reviewed, supplementary information is provided, and some of the documentation used in Volume I is presented. (Stewart-ARS) (Volume I [Report No. EPA 600/2-75-026a] is available from NTIS as report no. PB 249-517).

4031-B2, C1, E3, F1
FEEDER'S RECYCLING PLAN SAVES FIVE BUSHELS OF CORN FOR EACH STEER FED

Anonymous
Beef, V. 13, No. 7, p. 61, March, 1977.

Keywords: Recycling, Reconstituted corn silage, Confinement pens, Cattle, Flushing, Lagoons, Economics.

Agricultural Engineer, Robert George, describes a recycling plant that is saving one Midwest feeder about five bushels of corn on every steer he finishes. The feeder operates a flush-type confinement building, hooked to an outside lagoon. During a cleanup of the lagoon, it was found that near the discharge pipe the solids were too thick to pump. A laboratory check confirmed the resemblance of the solids to corn. Undigested bits of corn had passed through animals, into the lagoon, and settled near the discharge pipe. It was decided that the wet corn could be combined with ground corn stover to make the feeder's own "reconstituted" corn silage. The feeder reports that about 20,000 bushels of this material are reclaimed per year. Around 3,500 head per year are finished through the building, so he is reclaiming the equivalent of better than five bushels per animal. The moisture has presented a problem, but the use of cornstalks has pulled the moisture down from around 85 percent to 50 percent or 60 percent and has also trimmed the costs. (Keel-East Central)

4032-A8, B2, E2
CHANGES IN THE RHIZOSPHERE EFFECT OF MILLET ASSOCIATED WITH SPRINKLER IRRIGATION WITH ANIMAL WASTES

Department of Microbiology, University of Florida, Gainesville, Florida 32611
F. B. Dazzo, P. H. Smith, and D. H. Hubbell
Journal of Environmental Quality, V. 3, No. 3, p. 270-273, 1974. 5 fig., 2 tab., 9 ref.

Keywords: Sprinkler irrigation, Slurries, Liquid wastes, Millet, Microorganisms, Bacteria, Amino acids, Land disposal, Rhizosphere soil, Non-rhizosphere soil.

An investigation was made of microbial population changes in Scranton fine sand and adjacent millet rhizospheres resulting from sprinkler irrigation with cow manure slurry. Use of the R/S ratic, a ratio for comparing microbial populations per unit weight of rhizosphere soil (R) with the populations per unit weight of non-rhizosphere soil (S) calculated on an oven-dried basis, established that increasing the rate of irrigation with manure slurry resulted in a decline in the R/S ratio of ureolytic, proteolytic, amylolytic, and lipolytic microorganisms. Establishment of new nutritional niches within non-rhizosphere soil receiving liquid cow manure was reflected in the adjustments made among the predominant nutritional groups. There was a significant increase in the incidence of bacteria requiring amino acids and a decrease in the incidence of bacteria requiring soil extract within non-rhizosphere soil receiving manure applications. These findings seem to establish that the microbial environment created by irrigating Scranton fine sand with slurry may become nutritionally similar to the microbial environment created by the roots of millet during the summer. (Merryman-East Central)

4033-B1, C1, D1, D2
CONVECTIVE HEAT TRANSFER COEFFICIENT FOR POULTRY MANURE

Agricultural Engineering Department, University of Idaho, Moscow, Idaho
J. E. Dixon, G. D. Wells, and M. L. Esmay
Paper No. 76-4511, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 9 p. 2 fig., 2 tab., 4 ref.

Keywords: Poultry manure, Drying, Convective heat transfer coefficients, Equations, Metric units, American engineering units, Mass velocity, Length of air stream.

This study revealed that the equation $h_c = \alpha G^n / D_c^m$ can be used to estimate the heat transfer coefficient of poultry manure, if the constants α, m, and n are known. The constants were determined for use with metric and American engineering units. The constants using metric units were: $\alpha = 0.6330766$, $n = 0.398548$, and $m = 0.6014520$ where the variables were: G = mass velocity, grams/hr - sq cm and D_c = length of air-stream over drying manure, cm. The constants using American engineering units were determined to be: $\alpha = 0.122224$, $n = 0.402022$, and $m = 597978$ where the variables were G = mass velocity, lbs/hr - sq ft and D_c = length of air-stream over drying manure, ft. (Merryman-East Central)

4034-A11, B1
ENVIRONMENTAL FACTORS AFFECTING GROWTH PERFORMANCE OF TURKEYS

Department of Poultry Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia
A. E. Leighton, Jr., and J. P. Mason
Paper No. 76-4508, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 23 p. 6 fig., 9 tab., 17 ref.

Keywords: Turkeys, Environment, Performance, Growth, Ventilation, Temperature, Population density, Light, Modified elevated floors.

Results of a series of studies designed to determine the optimum environmental requirements of turkeys are presented. Environmental parameters studied included the effects of ventilation rate, temperature, population density, light, and modified elevated floors on growth performance of turkeys. The ventilation experiments indicated that considerably lower ventilation rates than those currently recommended can be used for turkeys when modified elevated floors are utilized in a growout program. Production of turkeys on flexibe floor material such as perforated plastic that allows droppings to pass through the floor into a pit: (1) allows increase of bird density to a maximum, (2) drastic reduction or elimination of poultry litter and litter management problems, (3) minimized manure disposal costs, (4) reduced disease hazards, and (5) marked reduction in the need for expensive drugs for prevention and treatment of certain diseases. Experiments were conducted to determine the effect of constant environmental temperatures of 10, 18.3, 26.7, and 35 degrees C and high and low energy diets on growth performance of Large White turkeys. The desirable temperature needed for optimum combination of growth and feed efficiency of 8-24 week old turkeys appeared to be 18.3 degrees C. Addition of up to 8 percent fat to the ration to improve feed efficiency seemed to be warranted. A series of experiments were designed to determine the effect of population density, of light regimes, and of wavelength of light at high and low intensities on growth performance of male and female turkeys. High population density was detrimental to growth performance. Lighting experiments indicated that it might be desirable to rear young poultry under diurnal or intermittent blue lights through 16 weeks. Then white or, preferably, red intermittent light could probably prevent the late period decline in weight gain experienced under continued use of blue light. Improved growth would more than compensate for the cost of light control management programs. (Merryman-East Central)

4035-A10
SUCCESSION AND ABUNDANCE OF INSECTS IN PASTURE MANURE: RELATIONSHIP TO FACE FLY SURVIVAL

Department of Entomology, University of Missouri, Columbia, Missouri, 65201
C. W. Wingo, G. D. Thomas, G. N. Clark, and C. E. Morgan
Annals of the Entomological Society of America, V. 67, No. 3, p. 386-390, 1974. 2 fig., 11 ref.

Keywords: Pasture manure, Flies, Ants.

All insects present in simulated field manure piles were collected after the manure was exposed to 1, 2, 3, 4, and 7 days to relate their presence and abundance to predation on the immature forms of the face fly, *Musca autumnalis* DeGeer. Of the 157 species of adult insects collected, only 32 were rated as abundant, numerous or common. The abundance and time of initial appearance at the manure indicate the following species can be important factors in predation upon immature forms of the face fly: *Harpalus caliginosus* (F.). *Harpalus* spp. and *Chlaenius tomentosus* Say on 3rd-stage larvae and puparia; *Hister abbreviatus* Say on eggs and all larval stages; *Sphaeridium* larvae on 2nd- and 3rd-stage larvae; *Philonthus cruentatus* Gmelin, *P. rectangulus* Sharp and *Aleochara bimaculata* (Gravenhorst) on eggs and larvae. Staphylinid larvae appeared too late to prey on immature forms of the face fly. The role of ants as predators in field manure was difficult to assess. The initial appearance at the manure of the 3 most abundant species of Scarabacidae indicated little possibility of competition with the face fly. (1974 Copyright-Annals of the Entomological Society)

4036-A10, B1
REARING AND RELEASE OF THE HOUSE FLY PUPAL PARASITE *SPALANGIA ENDIUS* WALKER

Insects Affecting Man Research Laboratory, Agricultural Research Service, USDA, Gainesville, Florida 32604
P. B. Morgan, R. S. Patterson, G. C. LaBrecque, D. E. Weidhaas, A. Benton, and T. Whitfield
Environmental Entomology, V. 4, No. 4, p. 609-611, 1975. 1 fig., 1 tab., 6 ref.

Keywords: Fly control, Poultry manure, Parasites.

A field-collected microhymenopteran pupal parasite, *Spalangia endius* Walker, was mass-cultured in the laboratory. Releases of these pupal parasites near an experimental population of house flies, which was breeding in poultry manure, caused complete eradication of the house flies within 30 days. All house fly pupae collected from the site 37 days after the releases were parasitized. (Copyright 1975-Environmental Entomology)

4037-B1, B5, C2, E2
LAND AVAILABILITY, CROP PRODUCTION, AND FERTILIZER REQUIREMENTS IN THE UNITED STATES

L. A. Prior
Publication SW-166, U. S. Environmental Protection Agency, Oct., 1975, 99 p. 12 fig., 25 tab., 26 ref.

Keywords: Animal wastes, Sewage sludge, Land disposal, Land availability, Crop production, Fertilizers, Nutrients, Nitrogen, Phosphorus, Potassium, Cropland, Urban areas, Strip mined land, Farms.

This report provides information on land availability, crop production, and fertilizer requirements in the United States as it relates to animal waste and sewage sludge utilization and disposal. Information on health effects, plant toxicity, metals content, and the relative economics of utilizing sewage sludge and animal waste on agricultural lands including collection, transportation, and application costs are not considered within the scope of this report. The Office of Solid Waste Management Programs, however, does intend to address these very important issues as part of its total effort on utilization of animal waste and sewage sludge. (Prior)

4038-B2, C2, D1, D3
NITROGEN TRANSFORMATIONS IN AERATED SWINE MANURE SLURRIES

Department of Soil Science, North Carolina State University, Raleigh, North Carolina
T. E. Loynachan, W. V. Bartholomew, and A. G. Wollum, II
Journal of Environmental Quality, V. 5, No. 3, p. 293-297, July-Sept., 1976. 9 fig., 3 tab., 18 ref.

Keywords: Slurries, Swine manure, Liquid wastes, Aeration, Nitrification, Denitrification, Nitrogen transformations, Temperature, Loading rates, Chemical analysis.

A study was conducted to evaluate nitrogen transformations that occur as a function of time in swine-manure slurries during aeration as affected by temperature, the aeration rate and the loading rate or slurry concentration. Periodic samples were collected and analyzed for residual organic N, NH_4-N, NO_2-N, and NO_3-N, as well as NH_3 volatilized from the aerated slurries. Although nitrification occurred in extensively aerated swine-manure slurries, about one-fourth of the total N was not mineralized in an 83-day period. This more resistant organic fraction represented nitrogen that would not easily be denitrified. Consequently, the nitrogen removal efficiency of a nitrification-denitrification sequence is limited. Another disadvantage in using a denitrification system for nitrogen removal was that only 30 percent of the added nitrogen occurred at any one time in a mineral form. This represented the maximum quantities of nitrogen available for a planned denitrification process. From 16 to 26 percent of the added nitrogen was volatilized as NH_3-N. From 48 to 67 percent of the added C was evolved as CO_2-C. The mechanism responsible for nitrogen losses was not determined, but NH_3 volatilization apparently predominated. Nitrogen loss increased with increase in temperature. It was felt that nitrification-denitrification schemes probably have limited application to nitrogen removal from waste substances. (Merryman-East Central)

4039-B2, B5, E2
NATURAL METHODS OF PURIFYING WASTE WATERS AND UTILIZING THEM IN AGRICULTURE, BIBLIOGRAPHY, PARTS 1 & 2

A. I. L'vovich, ed.
Natural Methods of Purifying Waste Waters and Utilizing Them in Agriculture, Bibliography, Parts 1 & 2, Draft Translation 505, U. S. Joint Publications Research Service for U.S. Army Cold Regions Research and Engineering Laboratory, 1975, 104 p.

Keywords: Bibliographies, Russia, Waste water purification, Irrigation, Land disposal.

This bibliography gives a list of Russian published material on agricultural utilization of waste waters and natural methods of purifying them on agricultural and municipal irrigation fields. Materials on questions of self-purification of the soil from pollutants and sanitary and hygienic evaluations of soil methods are presented as completely as possible. The bibliography was updated in 1971 to contain a total of 2,200 titles. (U. S. Army Cold Regions Research and Engineering Laboratory)

4040-A8, B2, B4, B5, C2, E2, F1

BACK TO BASICS--175-BUSHEL CORN FROM LEGUMES AND WASTES

J. Leidner
Progressive Farmer, V. 92, No. 2, p. 32-33, Feb., 1977. 4 fig.

Keywords: Land disposal, Swine wastes, Crop response, Corn, Hairy vetch, Fertilizers, Zero tillage, Minimum tillage, Waste storage, Economics

A northeast Alabama farmer, Lamar Brown, uses hog wastes and hairy vetch to manufacture practically all of the fertilizer needed for his corn crop. (Many years of commercial fertilizing have elevated residual potassium and phosphorus levels). He grows 300 acres of corn, which yield over 100 bushels per acre. Some of his fields receive more wastes than others, but all 300 acres spend the winter covered with hairy vetch. Brown uses zero tillage, which requires the use of paraquat, atrazine, Princep, malathion, and a small amount of 2, 4-D, and minimum tillage, which cuts out the use of three of the chemicals. The corn receives three loads of hog wastes in the fall and three loads in the spring, with 1500 gallons of hog wastes being spread per acre. The manure used has been stored for about six months in a SCS-designed concrete pit which holds ½ million gallons. The actual fertilizer value of hog wastes varies depending on dilution, feed source, amount of wasted feed, depth of pit, and length of storage, but approximate values for a ton of hog wastes are: 10 to 12 pounds of N, 6 to 7 pounds of P_2O_5, and 9 to 11 pounds of K_2O. This is worth about $4 per ton at current fertilizer prices. Recent Auburn University research shows that winter legumes such as vetch can supply the equivalent of 90 to 120 pounds of commercial nitrogen per acre for a following crop such as corn or cotton. (Bates-East Central)

4041-A11, B3, C2, E3

THE LAYING PERFORMANCE OF TWO STRAINS OF HENS OFFERED DIETS CONTAINING DRIED POULTRY MANURE DURING THE LAYING STAGE

Agricultural Research Council's Poultry Research Centre, King's Buildings, West Mains Road, Edinburgh EH9, 3FS, Scotland
D. J. W. Lee and W. Bolton
British Poultry Science, V. 18, No. 1, p. 1-7, Jan., 1977. 4 tab., 8 ref.

Keywords: Poultry, Refeeding, Dried poultry manure, Laying performance, Diets, True protein, Metabolisable energy, Calcium, Phosphorus, Energy content, Shell weight. Shell thickness, Albumen.

1. Light-weight (Babcock B300) and medium-weight (Warren-SSL) hens were offered diets, containing 0, 100 or 200 g dried poultry manure (DPM) and 11.49, 11.12 or 10.83 MJ metabolisable energy/kg respectively, between 18 and 70 weeks of age. The true protein, metabolisable energy, calcium and phosphorus contents of the DPM, from caged layer hens, were used in the diet formulation. 2. The hen-housed laying performance of hens offered the DPM-containing diets was significantly better for number of eggs laid and total egg mass produced but the performance of the control groups was lower than would normally be expected of those stocks. The reason for the lower rate of lay and higher mortality of hens fed on the control diet was not identified. The amount of food consumed increased as the energy content of the diet decreased and the efficiency of food conversion (EFC) of the light-weight strain was reduced; there was no significant effect on the EFC of the medium-weight hens. 3. The inclusion of DPM in the diets had no effect on albumen quality or on the incidence of hair-cracked, cracked or broken eggs. However, with both strains of hens, shell weight and shell thickness were poorer when 100 or 200 g DPM/kg diets were fed. (Copyright 1977-British Poultry Science)

4042-A4, A6, B2, B5, D1, E2, F1

HOG MANURE WORTH $3.50 PER TON AS FERTILIZER

Anonymous
Wallaces Farmer, V. 102, No. 5, p. 11, March 12, 1977.

Keywords: Liquid wastes, Swine manure, Land disposal, Cropland management, Fertilizers, Manure pits, Agitation, Odor, Agricultural runoff, Water pollution, Economics.

A. L. Sutton, Purdue University animal scientist, reports that liquid swine manure is worth about $3.50 per ton as a fertilizer if it is applied uniformly as near to the planting date as possible. An even better return could be realized by developing a manure management plan. The most effective planning depends on a nutrient analysis of the waste, compared with a soil test of the land and the nutrient requirements of the crops to be grown. Applying manure to corn, sorghum and small grains can increase the dollars benefit. Maximum corn yields have resulted from applying 40 to 80 tons of swine manure per acre per year on top of the soil. When supplementing the soil with a commercial fertilizer, this rate can be decreased. Sutton offers the following recommendations to producers who plan to apply liquid manure to cropland. First, the producer must remember that gas liberated from the manure pits is deadly. Consequently, adequate ventilation should be allowed while agitating the manure. Agitation of the manure facilitates removal of settled solids and uniformly distributes the nutrients. Reasonable distances from ponds, streams, open ditches, and residential areas should be maintained when applying manure in order to minimize runoff and odor problems. Actual spreading should be done early in the day, and manure should not be applied to unlevel frozen ground or water saturated soils. Soil injection or immediate incorporation of manure into the soil maximizes its fertilizer value and minimizes its odor problems. (Keel-East Central)

4043-A2, A4, B1, B4, C2, E1, E2, F2

ANIMAL WASTES MANAGEMENT

College of Engineering, Utah State University, Logan, Utah 84321
E. J. Middlebrooks
Public Works, p. 67-69, Feb., 1975.

Keywords: Livestock wastes, Waste management, Water pollution, Legal aspects, Feedlots. Manure spreading, Agricultural runoff, Nitrogen, Phosphorus.

Increased efficiency of agricultural production, and the influx of suburbia into rural areas has increased the recognition of the problems generated by handling and disposing of agricultural wastes. Proper planning and appropriate legislation is needed to strike a balance between adequate food production and proper waste management. Animal waste management would be simpler if the waste were to be collected in feedlots. But small beef and dairy cattle feeding operations, and poultry farms are scattered in relatively isolated areas, the majority along small streams. Many use the streams as a means of disposing of their wastes, causing pollution of our waterways, deplete the oxygen supply and add excessive quantities of nitrogen and phosphorus. Manure spreading is practiced by small animal farms, but as the size of these farms increases, it necessitates hauling the excess manure to other disposal sites or attempts to sell the manure as a soil conditioner, with little success. It is known that the impact on the water quality caused by animal wastes is due to the periodic sludge discharges of pollutants that reach a waterway. A number of feedlot runoff control measures, such as diversion, retention ponds, confinement, proper location, use of evaporation ponds, and land disposal of the excess liquid. (Solid Waste Information Retrieval System)

4044-A8, B5, C2, E2

ARSENIC CONTENT OF CORN GRAIN ON A COASTAL PLAIN SOIL AMENDED WITH POULTRY MANURE

Department of Plant Science, University of Delaware, Newark, Delaware
W. C. Liebhardt
Communications in Soil Science and Plant Analysis, V. 7, No. 2, p. 169-174, 1976. 1 tab., 10 ref.

Keywords: Arsenic, Poultry manure, Feed additions, Soil amendments, Crop response, Corn grain.

The concentration of arsenic in corn grain was not affected by the use of poultry manure from chickens which had been fed 3-nitro 4-hydroxy phenyl arsonic acid. Corn was grown on plots receiving in excess of 600 Mt/ha over a three year period which is 10 to 20 times normal use. The results indicate that arsenic is not concentrated in corn grain when manure from chickens fed 3-nitro 4-hydroxy phenyl arsonic acid as a feed additive is used as a soil amendment on Delaware's sandy coastal plain soils. (Copyright 1976-COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS)

4045-A8, B5, C2, E2
NUTRIENT CONCENTRATION OF CORN AS EFFECTED BY POULTRY MANURE

Department of Plant Science, University of Delaware, Newark, Delaware
W. C. Liebhardt
Communications in Soil Science and Plant Analysis, V. 7, No. 2, p. 175-188, 1976. 14 tab., 10 ref.

Keywords: Poultry manure, Land application, Application rates, Nutrient concentration, Plant tissue, Crop response, Magnesium, Manganese, Calcium, Iron, Sodium, Boron, Zinc.

The elemental composition of corn was evaluated during the 1973 growing season in an experiment with various rates of poultry manure. In general, the nutrient concentration of plant tissue reflected poultry manure applications with the exception of Mg which declined and Ca, Fe and Na which appeared to be largely unaffected. The elemental concentrations in the corn tissue were not in a toxic range however, the nutrient balance was changed by poultry manure application. Samoling of corn early in the growing season can be quite valuable with respect to predicting nutrient concentration of more mature corn for Mg, Mn, B and Zn, but it leaves much to be desired for the other elements tested. (Cooyright 1976-COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS)

4046-A8, E2
EFFECT OF POULTRY MANURE ADDITIONS ON THE EXTRACTABILITY OF AN ADDED METAL

Department of Land Resource Science, University of Guelph, Guelph, Ontario, Canada, N1G 2W1
P. R. Warman and R. L. Thomas
Communications In Soil Science and Plant Analysis, V. 7, No. 4, p. 405-414, 1976. 1 tab. 13 ref.

Keywords: Poultry manure, Land application, Application rates, Metals, Extractability, Soils, Cadmium.

Soils, to which poultry manure had been added at either, zero, 11.2, or 56.1 metric tons/ha, were sampled at 1, 10, 40 and 160 days after the addition. The effect of the remaining organic matter on metal extractability was studied using Cd as an indicator ion. Less of the added Cd could be extracted as exchangeable Cd or complexed Cd (CuOAc extractable) as the rate of manure addition increased. An HC1 extract removed some of the retained Cd, but the total Cd extracted (exchangeable plus complexed plus HC1 extractable) was lower at the highest rate of manure addition. The longer the manure decomposed, the more pronounced was the effect on Cd extractability. The results indicate that the amount of an organic matter addition, and its stage of decomposition will affect the retention of a metal in a soil. (Copyright 1976 - COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS)

4047-A2, A8, B1, C2
FEEDLOT WASTE RUNOFF AND MORTALITY OF WINDBREAK TREES

Research Forester, Rocky Mountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Lincoln, Nebraska 68508
D. F. Van Haverbeke, L. Chesnin, and D. R. Miller
Journal of Soil and Water Conservation, V. 31, No. 1, p. 14-17, Jan.-Feb., 1976. 9 fig., 10 ref.

Keywords: Feedlots, Agricultural runoff, Tree mortality, Sampling, Soil profile, Soil pH, Conductivity, Heavy metals, Sodium, Toxicity.

Runoff from confinement feedlots, flowing through windbreaks killed mature trees. Soil profile samples showed that the feedlot runoff, during a period of 2 to 3 years, increased the soil pH and conductivity and altered the exchangeable cation status in the dead-tree areas. We don't believe these changes were sufficient to kill the trees, although sodium saturation was too high within the feedlots to support normal plant growth. Heavy metals and organic substances (or their decomposition products) leaching through the soil could also have been toxic to the trees. We recommend grading to divert the flow of wastes away from established windbreaks or selecting upslope locations for new plantings. (Copyright 1976-JOURNAL OF SOIL AND WATER CONSERVATION)

4048-B1, C3, D3, E3
MICROBIAL POPULATION CHANGES AND FERMENTATION CHARACTERISTICS OF ENSILED BOVINE MANURE-BLENDED RATIONS

National Sales, Inc., P.O. Box 1019, Jackson, MS 39205
E. F. Knight, T. A. McCaskey, W. B. Anthony, and J. L. Walters
Journal of Dairy Science, V. 60, No. 3, p. 416-423, March, 1977. 6 fig., 2 tab., 20 ref.

Keywords: Rations, Cattle manure, Refeeding, Ensiling, Fermentation, Microbial population, Moisture content, pH, Lactic acid, Coliforms, Yeasts, Molds, Salmonellae, *Streptococcus faecalis*, *Lactobacillus plantarum*, Feedlots, Confinement pens.

Manure from beef steers confined on concrete was blended with a basal ration at 20, 40, and 60 percent and ensiled at 25 C. The moisture content of the rations increased with manure added. The rations with higher moisture developed a lower pH and higher lactic acid during the 10-day ensiling. Coliform bacteria were not detected in rations with 40 percent and 60 percent manure after 5 days ensiling and after 10 days in the 20 percent manure-blended ration. Coliform count of the basal ration (no manure) remained constant at about 104/g. When pH dropped to 4.4 to 4.7, coliforms died in all manure-blended rations. Salmonellae were isolated twice from 66 samples of the manure-blended rations and ration constituents (basal ration and manure) prior to ensiling. Salmonellae were not recovered from the salmonellae positive manure-blended rations after 3-days ensiling. Sporeforming bacteria survived but did not proliferate in the ensiled rations. The predominant acid-producing bacterium in the manure-blended rations prior to ensiling was *Streptococcus faecalis*. After 10 days ensiling *Lactobacillus plantarum* was the predominant type. (Copyright 1977-Journal of Dairy Science)

4049-A5, B2, B4, C2
ACCUMULATION OF NUTRIENTS IN SOIL BENEATH HOG MANURE LAGOONS

Department of Land Resource Science, Ontario, Ministry of Agriculture and Food
M. H. Miller, J. B. Robinson, and D. W. Gallagher
Journal of Environmental Quality, V. 5, No. 3, p. 279-282, July-Sept., 1976. 6 tab., 11 ref.

Keywords: Lagoons, Swine wastes, Soils, Sampling, Nutrients, Feedlots, Groundwater pollution, Seepage, Waste storage, Nitrogen, Phosphorus, Nutrients.

The soils beneath 4 hog manure lagoons were sampled during the spring and summer of 1974 to determine the extent of nitrogen and phosphorus accumulation. Arrangements were made with lagoon owners to lower the manure level as far as feasible. Lagoon 1, a 2-year-old lagoon, was on a clay loam to clay calcareous till. Lagoon 2, a 2-year-old lagoon, was on a lacustrine clay deposit. Lagoon 3, a 10-year-old lagoon, was on a loam to sandy loam calcareous till. Lagoon 4, an 8-year-old lagoon, was on layered fine sandy loam, silt loam and silty clay loam. Levels of NH_4-N and soluble P were very high in the top cm of lagoon 1, but decreased sharply at lower depths. Soluble P at the 10-20 cm level was not above the background level (0.05-0.20 μg/g). NH_4 -N at the 20-30 cm depth was slightly above the background level (1.6-7.1 μg/g). The NO_3 -N level in the soil was very low. The NH_4-N content below lagoon 2 was very high in the top 20 cm but was not above background (0.3-1.5 μg/g) below that depth. Soluble P and nitrate nitrogen did not accumulate below lagoon 2. This may have been due to removal of the upper 1-2 cm of soil with the thick layer of organic material that was present in this lagoon. The NH_4 -N content of the soil below lagoon 3 was very high even at the 140-150 cm depth compared to the background levels (<1 μg/g). Soluble P accumulated in the 0-10 cm depths but not at deeper depths. NO_3-N levels were very low at all depths. NH_4-N levels in lagoon 4 were very high at all depths sampled—even at a depth of 400 cm. Soluble P was very high in the top 30 cm. NO_3-N levels increased between sampling times, indicating the conversion of NH_4-N to NO_3-N took place following emptying of the lagoon. Clay content and age of lagoons 1 and 2 seemed to be the factors involved in the contrasting results between lagoons 1 and 2 and lagoons 3 and 4. The experiment indicated that the most satisfactory use of lagoons would be on fine-textured soils. (Merryman-East Central)

4050-A4, A5, B1
THE IMPLICATION OF HYDROGEOLOGIC FACTORS IN WASTE MANAGEMENT ON LAND (WITH SPECIAL REFERENCE TO THE NOVA SCOTIA ENVIRONMENT)

Water Planning and Management Division, Nova Scotia Department of the Environment, P. O. Box 2107, Halifax, Nova Scotia B3J 2X1, Canada
J. F. Jones and J. E. Gibb
Proceedings of the International Conference on Land for Waste Management, Ottawa, Canada, Oct., 1973, p. 147-160. Department of the Environment and National Research Council of Canada, 1974. 6 fig., 1 tab., 19 ref.

Keywords: Hydrogeology, Waste management, Nova Scotia, Canada, Water pollution, Groundwater pollution, Sewage lagoons, Animal wastes.

The importance of hydrogeologic factors in waste management must be revealed to the public and to the planners of waste management systems in order to minimize environmental pollution. Ignorance of the implications of such factors has often resulted in groundwater and surface water pollution from such sources as leachate from septic tanks, industrial sewage lagoons, farm animal waste, and solid waste disposal sites. Hydrogeologic factors of particular importance for the protection of groundwater and surface water in Nova Scotia include the groundwater flow systems, groundwater recharge and discharge areas, geology, topography, seasonal and climatic factors, the influence of pumping wells, etc. A continuing program of collection of hydrogeologic data should be maintained in Nova Scotia so that this information will be available to the appropriate agencies. These data should be reduced so that they can be understood by non-hydrogeologists. Blanket regulations regarding waste disposal site locations are inadequate. Since conditions vary from area to area, an on-site hydrogeologic investigation is needed to determine the suitability of a given area for waste disposal. (Merryman-East Central)

4051-B3, D3, E3, F1
MANURE

Anonymous
Feedlot Management, V. 16, No. 4, p. 30, April, 1974.

Keywords: Composting, Recycling, Fuels, Energy, Economics, Cattle manure, Organic wastes.

Scientists have learned that organic wastes, such as animal manures, urban sewage, sludge, garbage, and refuse, when composted produce a clean, sulphur-free fuel resembling lignite. This stable, brown compost-fuel can be produced for a lower cost than oil, propane, natural gas, coal or other such fuels. The compost-fuel can be combined with other wastes, such as crank case oil, to produce a fuel mixture with an energy capacity higher than compost's BTU rating when needed. Compost-fuel need not be confined to agricultural uses only; it can perform other heating functions such as heating buildings and can be an important additive to other fuels for the generation of steam and electricity. Manure, when composted into fuel, could produce the energy value of 109,440 barrels of oil. The selling value of this fuel would be $1,094,400, with oil at $10 per barrel. Use of compost-fuel made from cattle feedlot manures alone would supply energy exceeding the total propane and other fuels such as natural gas and oil used in grain drying of corn, soybeans, rice, etc. (Merryman-East Central)

4052-A1, A8, B2, C2, D3, E2
HAZARDS ASSOCIATED WITH SPREADING ANIMAL-WASTE SLURRIES

Agricultural and Food Chemistry Research Division, Ministry of Agriculture, Newforge Lane, Belfast, Northern Ireland
I. S. Cornforth
Proceedings of the International Conference on Land for Waste Management, Ottawa, Canada, Oct., 1973, p. 253-263. Department of the Environment and National Research Council of Canada, 1974. 2 fig., 4 tab., 20 ref.

Keywords: Slurries, Animal wastes, England, Northern Ireland, Land, Spreading, Environmental effects, Odor, Diseases, Water pollution, Soil physical properties, Waste management, Phosphorus, Potassium, Crop response, Refeeding, Separating, Byproducts.

Geographically, problems of waste disposal are least in eastern England where rainfall is low, soils are predominantly light textured, and farms are mixed or arable. Here the problems are basically odor, disease spread, and possibly water pollution. All the problems associated with spreading slurry on land intensify as one moves west across the British Isles. This is because the rainfall increases, the proportion of arable land declines, soils are generally heavier in texture, and land surfaces become steeper. In western England and Northern Ireland animal production predominates and the harmful effects of excess slurry on soil physical properties are important. A further problem resulting from the spreading of animal wastes on land in Northern Ireland is the accumulation of plant nutrients in the soil. Intensive animal production based on imported concentrate feeds results in a net input of plant nutrients on the farm land. Since little of the land is cultivated, phosphorus and potassium (neither of which is very mobile) accumulate in the top few centimeters of soil. This has two consequences. Nutrient balance in the grass is upset. High concentrations of potassium suppress the uptake of magnesium, with the result that stock grazing the grass suffer from magnesium deficiency and possibly from reproductive failure caused by high K concentrations. Also, grass roots appear to be restricted to the nutrient-rich surface horizons, resulting in uprooting of whole grass plants by grazing animals. Thus, the sward is rapidly and severely damaged. Alternative methods for disposing of animal wastes in high-risk land areas include: (1) drying poultry manure for inclusion with ruminant feeds, (2) aerobically treating the wastes to decrease the biological oxygen demand, (3) separating the solid and liquid fractions of slurry, drying and subsequently burning the solids fraction; the liquid fraction may be spread on land or, after aerobic treatment, treated in domestic sewage works, and (4) using the liquid fraction of slurry as a nutrient medium for growing high-protein stock feeds of fungal or algal origin. (Merryman-East Central)

4053-A10, A11, A12, B1, C3, E2
FATE OF PATHOGENS IN SOILS RECEIVING ANIMAL WASTES

Agricultural Research Service, U. S. Department of Agriculture, Lincoln, Nebraska
J. R. Ellis and T. M. McCalla
Paper No. 76-2560, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 23 p. 3 tab., 54 ref.

Keywords: Land disposal, Animal wastes, Pathogenic bacteria, Disease, Vectors.

Applications of manure to the soil has normally been a sound practice; however, there are exceptions. If wastes are applied at a rate that exceeds soil capacity to assimilate them, the environment may be contaminated and disease may result. Also, if contaminated with anthrax, foot-and-mouth-disease virus, and other long-lived pathogenic organisms, manure may need special treatment. The major concern in land disposal has been that pathogens present in wastes may escape the process of soil purification long enough to produce a unique pathogen hazard or become a disease vector to infect man or other animals. As a general rule, most pathogens are competitors outside the host. Factors which influence pathogen survival in waste material and soil are: waste treatment, moisture, sunlight, pH, temperature, antibiotics, toxic substances, competitive organisms, available nutrients, organic matter, and soil type. Most researchers seem to feel that, if proper precautions are used, the spreading of animal wastes on the land is rarely a health hazard. Recycling of waste to the land is normally a sound policy and has been used for centuries to decontaminate wastes. (Merryman-East Central)

4054-A3, A8, B1, C2, E2
AMMONIA VOLATILIZATION OF WINTER SPREAD MANURE

Agricultural Engineering Department, University of Wisconsin, Madison, Wisconsin
T. S. Steenhuis, G. D. Bubenzer, and J. C. Converse
Paper No. 76-4514, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 17 p. 5 fig., 6 tab., 19 ref.

Keywords: Ammonia, Volatilization, Land spreading, Winter, Dairy manure, Application rates, Freeze-thaw cycles, Dehydration, Urea-ammonium conversion rate, Wind, Humidity, Freezing, Thawing, Agricultural runoff, Infiltration.

Laboratory and field experiments were conducted to determine ammonia volatilization rates from winter spread manure. Factors considered were: manure application rate, freeze-thaw cycles, dehydration and urea-ammonium conversion rate. The following conclusions were drawn from the experiments: (1) Lower temperatures and lower wind speeds reduced ammonia volatilization. (2) Conversion of urea to ammonia, which is temperature dependent, may be the limiting factor of ammonia volatilization following winter spreading. (3) Relative air humidity had no appreciable effect on volatilization. (4) Higher application rates increased volatilization half life. (5) Freezing and thawing did not increase volatilization rate. (6) It would seem that winter spreading would result in less volatilization of ammonia because wind speeds and temperatures are normally lower and much of the manurial nitrogen is in urea form. However, melt water in runoff events may contain a large portion of the yet unvolatilized nitrogen. The loss of nitrogen due to surface runoff will depend upon the portion of the melt water that infiltrates. (Merryman-East Central)

4055-A6, B2, B4, D1, D3, E2, F1
HOGMEN SIZE UP OXIDATION SYSTEMS

L. Musil
Kansas Farmer, V. 113, No. 15, p. 8, 57, Sept. 4, 1976. 4 fig.

Keywords: Liquid wastes, Swine wastes, Oxidation systems, Racetrack pits, Odor control, Costs, Waste treatment, Lagoons, Waste storage, Evaporation, Cropland management, Land disposal.

The use of aerobic oxidation to decompose swine manure is described by Paul Smart, Douglas County, Kansas hog farmer, and Dr. Berl Koch, KSU swine scientist. Smart operates a 50-acre operation, composed of 7500 hogs that excrete approximately 30 tons of raw manure daily. Dr. Kock notes that aerobic oxidation is the most effective and also one of the more expensive methods of handling manure. Smart's system employs an electrically driven paddle wheel, 5 feet in diameter, which fits into a 38-inch wide pit. KSU uses an electrically driven propeller. Both systems churn the waste around racetrack pits under slats so that oxygen breaks the organic matter into CO_2 and H_2O, thus eliminating almost all odor at both operations. Lagoons at Smart's operation accomodate effluent overflows from the racetrack pits and

In the 11 years of operation, have never had to be drained. The lagoons fill during the winter and recede during the summer. Problems found in Smart's operation include collection of hairs in the bearings, foam on the bearings and belts, and belt breakage. At KSU, effluent from the race-track pits drains into storage tanks that are emptied periodically and spread on cropland. KSU's propellers are powered by 3-horse power sealed dustproof motors that use 50-70 kilowatt hours daily. Propellers last about 6 months and motors about 3 years. Yearly cost is about $5,000 for the 100 sow unit or $1.50 to $3.50 per day per building. This compares with Smart's electricity costs of about $90 per day for his 7500 hogs. (Keel-East Central)

4056-A7, A10, A11, B3

BUILT-UP LITTER SAVES US TIME AND MONEY

Armour Food Company, Gonzales, Texas 78628
M. M. Reger
Poultry Digest, V. 36, No. 421, p. 141-142, March, 1977, 1 fig.

Keywords: Litter, Economics, Turkeys, Brooders, Management, Disease, Molds, Vectors, Dust.

Mark Reger, Armour Food Corporation, reports on the reuse of in both turkey brooding and total confinement houses. For two years this practice has been used on a large farm with 3 brooding units which brood six groups of 60,000 turkeys per year. Wood shavings are used for litter. By reusing built-up litter, the expense of removing, disposing and spreading is decreased. Reger made the following observations of the reuse of litter: (1) With new litter, bare spots show up but built-up litter can be as deep as you desire, (2) Wet spots from water spills are much easier to manage, (3) New litter is not always clean, dry and free from pathogenic organisms, (4) Built-up litter will begin to compost and clean itself up. Reger reports that any worm, bacteria or mold build-up has not been detected, and (5) Most of the time there is less excess dust in built-up litter than in new litter. (Keel-East Central)

4057-A11, A12, B1, C1, C2, C3, D1, D2, D3, E3, F1, F2, F3, F4

SEMINAR ON FEEDLOT MANURE RECYCLING FOR NUTRIENT RECOVERY

Seminar on Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 82 p.

Keywords: Refeeding, Animal wastes, Recycling, Confinement pens, Feedlots, Performance, Rations, Pathogenic bacteria, Legal aspects, Economics, Waste management, Equipment.

A seminar was held in which a cross section of animal scientists, agricultural consultants, microbiologists, agricultural engineers, and EPA and FDA representatives participated for the purpose of examining the potential of refeeding animal wastes. While drawbacks were cited, the overall consensus of opinion seemed to be that the refeeding of animal wastes was a viable waste management alternative. (Merryman-East Central)

4058-B1, C1, C2, E3, F1

REFEEDING POTENTIALS: FACTS AND FANTASIES

Texas Agricultural Experiment Station, Department of Animal Science, Texas A&M University, College Station, Texas
L. M. Schake
Seminar on Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 4 p. 12 ref.

Mr. Schake, a Texas A&M professor in the Department of Animal Science, examined objectively the facts and fantasies associated with animal waste refeeding. The following observations were made: (1) The practice of animals eating wastes is a natural process which animals have performed on their own for many years. Therefore, waste refeeding may be viewed as the controlled extension of natural nutrient recycling, rather than a new and perhaps absurd idea. (2) Waste recovery and processing systems that add little, if any, nutritional value to the potential feed must be seriously questioned—especially if these systems are energy intensive. (3) Animal wastes are of variable composition. In contemplating a refeeding system, one must consider the composition and uniformity of the waste to be fed. (4) No closed system of total waste refeeding has been developed whereby all waste produced and harvested may be successfully refed to an equal number and type of cattle. Logically this could never be accomplished. (5) Most waste will be distributed to land as fertilizer, either directly or indirectly. Refeeding may allow a portion of the waste to be cycled into feed mixtures once or twice before disposal, but ultimately it will return to the land. Hence, refeeding must be of enough economic benefit to include it as a portion of the feed mixture as opposed to acquiring more conventional feeds. (6) The major limitation of waste refeeding centers about the recovery-collection processes. Research emphasis should focus upon the utilization of fresh high moisture waste close to site of production. (Merryman-East Central)

4059-A11, B1, B3, C1, C2, D1, E3

USE OF WASTE FROM OPEN FEEDLOTS FOR FATTENING, GROWING AND MAINTENANCE RATIONS

Department of Animal Science, Texas Tech University, Lubbock, Texas
R. C. Albin
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 7 p. 6 tab., 13 ref.

Keywords: Open feedlots, Refeeding, Performance, Economics, State of the Art, Digestibility, Palatability, Stockpiling, Ash, Crude protein, Dry matter, Moisture content, Dustiness.

A current ''state of the art'' of using waste from open, dirt-surfaced, commercial beef cattle feedlots in rations for beef cattle is presented. The following conclusions were drawn: (1) Digestibility of crude protein in such wastes is low (26-40 percent). (2) Digestibility of dry matter and organic matter (and energy since they are closely related) averages about 35 to 40 percent, considerably lower than most concentrates, but only somewhat lower than the dry matter digestibility of low quality forages. (3) Composting appears to decrease crude protein digestibility, but it increases cell wall material digestibility. (4) Acceptability (palatability) of rations containing the material is not affected. (5) No detectable, adverse side effects upon animal health were reported. (6) Feedlot waste is difficult to grind if the moisture content is higher than 20 percent. If the waste contains about 12 percent water or less, dustiness becomes a problem. (7) In spite of cautionary procedures, dirt contamination, resulting in an ash content higher than 33 percent, is a consistent problem. (8) Due to the low energy content, levels of greater than 5 percent feedlot waste in a finishing ration will reduce performance and economic alternatives must be evaluated. (9) Levels of greater than 5 percent feedlot waste would need to be utilized in growing rations and maintenance rations for beef cows, but again, economic alternatives must be considered. (10) Removal of waste from the feed yard pen, piling, possibly spreading to partially dry, repiling, passing through a grinder, and stockpiling for feeding results in a ''free'' feed ingredient with a $15 to $20 per ton handling cost. (Merryman-East Central)

4060-A6, A11, B2, B3, C1, C2, C3, D1, D2, D3, E3

HARVESTING AND PROCESSING MANURE FROM CONFINEMENT OPERATIONS FOR REFEEDING

Agricultural Engineering Department, University of Illinois, Urbana, Illinois 61801
D. L. Day
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 15 p. 6 fig., 4 tab., 13 ref.

Keywords: Confinement buildings, Refeeding, Waste treatment, Ensiling, Chemical treatment, Odor control, Pathogenic bacteria, Palatability, Economics, Climate, Floors, Feedbunks, Nutrients.

This paper discusses methods of harvesting and utilizing manure for refeeding from beef confinement buildings to minimize nutrient losses, labor and odors. Such factors as climate, housing versus open lots, floor types and shapes, feedbunks, methods of processing wastes, and amounts of wastes that can be refed are considered. Processing is necessary for odor and pathogen control and for making the produce palatable. Primary methods for processing beef wastes for refeeding are ensiling and chemical treatment. Confinement buildings have the advantage of allowing frequent harvesting of wastes to avoid major nutrient losses that occur in conventional storage. Also, confinement buildings protect the bunks from rain that can spoil feed, especially if it contains processed wastes. While confinement buildings require a high initial investment, it is felt that facility costs can pay for themselves in reduced labor requirements and increased performance of the animals while saving space and achieving pollution control. (Merryman-East Central)

4061-A11, B1, C1, C2, D1, E3

FORMULATING AND MILLING FEEDS CONTAINING MANURE FROM OPEN FEEDLOTS

Feedlot Consultant, Indian Wells, California
J. D. Aughtry
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 10 p. 3 tab.

Keywords: Feeds, Open Feedlots, Refeeding, Performance, Waste treatment, Chemical properties, Physical properties.

Manure collected from open feedlots can be used as a feed ingredient in fundamentally sound, properly balanced, complete feedlot rations at least-cost levels of up to 15 percent of the total feed without adversely affecting dry matter intake or performance of cattle.

Manure can usually be collected dry from open feedlots during dry seasons in arid and semi-arid regions of the West and stored for year around use. When collected dry, the manure needs no processing except grinding. Because manure from open feedlots is variable in composition, quality control is essential. (Merryman-East Central)

4062-A11, B1, C3, D2, D3, E3

PATHOGEN TRANSMISSION POTENTIAL FROM ANIMAL WASTE REFEEDING

Department of Animal Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia
J. P. Fontenot
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 12 p. 5 tab., 34 ref.

Keywords: Refeeding, Pathogenic bacteria, Parasites, Waste treatment, Animal health, Poultry litter, Ensiling, Methylbromide fumigation, Autoclaving, Paraformaldehyde, Ethylene oxide fumigation.

It is recommended that wastes be processed to destroy potential pathogens. The type of process to be used is dependent upon the kind of waste, the kind of enterprise, and the resources available. Procedures which have been found to destroy pathogenic organisms include dry heat, moist heat, chemical treatment, and fermentation. If animal wastes are properly processed, disease transmission due to refeeding does not seem to be a serious problem. (Merryman-East Central)

4063-A9, A11, B1, C2, E3

RESIDUE TRANSFER AND ACCUMULATION

Animal Physiology & Genetics Institute, Feed Energy Conservation Laboratory, Beltsville, Maryland 20705
C. C. Calvert
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 22 p. 13 tab., 18 ref.

Keywords: Refeeding, Feed additives, Animal health, Cattle, Sheep, Dried poultry excreta, Heavy metals, Pesticides, Hormones, Arsanilic acid, Arsenic, Amprolium, Copper, Zinc, Iron, Cadmium, Lead.

This report describes the general categories of feed additives, indicates which additives have more potential in creating problems for refeeding, reviews work that has been done to determine whether specific additives are contributing residues to excreta, and describes the distribution of some of these residues in tissues of excreta-fed animals. Excreta residues of heavy metals, pesticides and hormones are also considered. In one study, litter containing the coccidiostat amprolium was fed to steers. After a 5-day withdrawal period, no significant difference in tissue amprolium was found at 0, 25, or 50 percent feed levels for either 121 or 198 days. In studies utilizing arsanilic acid in feeds for sheep, an average of 87 percent of the ingested arsenic was excreted in the feces. Arsenic from arsanilic acid fed at levels up to 273 mg/kg of diet was detected in sheep tissues. Levels in tissues were proportional to levels fed. A 6-day withdrawal period seemed to be sufficient to decrease tissue arsenic to acceptable levels for all but the higher dietary levels. Chlorinated hydrocarbon pesticides and exogenous and endogenous hormones have not been found to pose a problem in refeeding. In a study utilizing dried poultry excreta (DPE) in steer rations, copper, zinc, and iron levels were significantly increased. Cadmium and lead contents were unchanged. The only significant differences in tissue heavy metal levels were an increase in levels of liver copper and kidney iron and a decrease in levels of kidney cadmium in steers fed DPE. Dietary copper increase resulted from high copper levels in DPE from laying hens fed copper sulfate. Decrease in levels of kidney cadmium was probably due to a substantial increase in intake of dietary zinc in DPE-supplemented diets. (Merryman-East Central)

4064-A11, A12, B1, C2, C3, E3, F2

PROVISIONS OF STATE AND FEDERAL REGULATIONS ON REFEEDING

Division of Swine and Minor Species, Food and Drug Administration, 5600 Fishers Lane, Rockville, Maryland 20857
J. C. Taylor and R. E. Geyer
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 7 p.

Keywords: Refeeding, Regulation, Legal aspects, Feed additives, Animal health, Public health, Food, Drug, and Cosmetic Act.

The Food and Drug Administration is responsible for administering the dictates of the Food, Drug, and Cosmetic Act, which became law in 1906, was rewritten in 1938, and has been amended several times. The 1958 feed additives amendment defines ''food'' to include ''articles used for food or drink for man or other animals.'' Since animal feed is ''food'' under the Act, it is subject to regulatory action if it is adulterated--''bears or contains any poisonous or deleterious substance which may render it injurious to health.'' If the substance is not an added substance, then the food is not considered adulterated if the quantity of the substance doesn't ordinarily cause health problems and in unavoidable in good manufacturing practice. Section 402 of the Act also states that a food is adulterated if it consists wholly or in part of filth, putrid or decomposed substances, or is ''otherwise unfit for food.'' The last phrase provides opportunity for distinction between human food and animal feed. For instance, a substance that is unfit for human food because of aesthetic reasons might not be unfit for animal food. Section 402 also declares to be adulterated food that ''is, bears or contains any food additive which is unsafe within the meaning of section 409.'' Section 409 provides that a food additive is unsafe unless there is in effect a regulation prescribing the conditions under which it can be used safely. Even if recycled waste is adulterated within the meaning of the Food, Drug, and Cosmetic Act, it is not within the jurisdiction of the Act unless an interstate commerce element is present. While the FDA can regulate interstate and probably even intrastate shipment of recycled animal waste, typically this regulation is a cooperative state-federal effort. The FDA is presently seeking outside assistance in answering the unresolved safety questions relating to refeeding and hopes to publish a notice summarizing the information gathered in the Federal Register in the Spring of 1977. (Merryman-East Central)

4065-A9, A11, B1, C2, C3, D1, D2, E3, F1

PRESERVATION AND REFEEDING POULTRY WASTE TO CATTLE

Masters Agri Consultants, Inc., Athens, Georgia
G. C. Masters
Seminar of Feedlot Manure Recycling for Nutrient Recovery, East Central University, Ada, Oklahoma, April 7, 1977, 3 p.

Keywords: Refeeding, Poultry wastes, Cattle, Chemical analysis, Biocides, Pathogenic bacteria, Waste treatment, Physical treatment, Chemical treatment, Economics, Grazon.

Masters Agri Consultants, Inc. suggests the following techniques for mixing and feeding wastes: (1) Litter is cleaned out of poultry houses by commercial crews and loaded into large dump trailers for movement to the feedlot. (2) Litter is removed from the stockpile at the feedlot with a front end loader and put into a horizontal mixer which has scales. (3) Water is added to the litter in the mixer to increase moisture to about 35 percent. (4) Grazon is sprinkled on the moisturized litter at the rate of 1 gal/ton, while the batch is mixing. (5) Corn and other ingredients are added by weight as the mixer continues to run. (6) The mixed feed is then conveyed into feed troughs. It must be recognized that waste feeding does not guarantee profits. Improper management, supervision and control can lose feeders more money than the waste feeding can save. In some time periods, low market prices may cause almost all feeders, regardless of efficiency, to lose money. Feeders should bear the following recommendations in mind: (1) Feed waste only in states where state feed inspection divisions allow the practice. (2) Verify what chemicals are used in the feed from which you intend to recover waste for cattle feeding. (3) Verify what sprays or other contaminants may have been used on the waste to control flies, odors, beetles, etc. (4) Run periodic laboratory analyses to verify lack of contamination. (5) Process in a manner which will destroy any pathogens which might affect livestock. (Merryman-East Central)

4066-A11, A12, B2, D1

DON'T BE CAUGHT DEAD PUMPING MANURE

Anonymous
Hoard's Dairyman. V. 122, No. 4, p. 282, March 10, 1977.

Keywords: Liquid wastes, Waste storage, Gases, Agitation, Ammonia, Carbon dioxide, Methane, Hydrogen sulfide, Ventilation.

Liquid manure storage produces several hazardous gases which are released quickly during agitation. While ammonia, carbon dioxide and methane are irritants, hydrogen sulfide can cause instant breathing paralysis and death. Problems with these gases may be avoided by: (1) agitating manure tanks when buildings can be opened and ventilated, (2) keeping humans and animals away from the buildings during agitation, (3) ventilating under floor pits, using fans turned up to optimum capacity, and (4) pulling air from confinement buildings down through the tank and exhausting to the outside. A manure tank should not be entered unless absolutely necessary. If it must be entered, an auxiliary air supply and two persons handling a rope tied around the body of the person entering the tank are musts. (Merryman-East Central)

4067-A2, B1, C1, C2, C3, D3, E2, E3

MANURE HARVESTING PRACTICES: EFFECTS ON WASTE CHARACTERISTICS AND RUNOFF

Colorado State University, Fort Collins, Colorado 80523
R. W. Hansen, J. M. Harper, M. L. Stone, G. M. Ward and R. A. Kidd
Environmental Protection Agency Report EPA-600/2-76-292, Dec., 1976, 104 p. 10 fig., 21 tab., 80 ref.

Keywords: Feedlots, Manure harvesting, Surfaced conditions, Partially surfaced conditions, Unsurfaced conditions, Waste management, Agricultural runoff, Chemical properties, Physical properties, Biological properties, Animal density, Ash, Refeeding, Waste treatment, Fertilizers.

To develop a basis for better manure harvesting management practices, a combined field and laboratory study was conducted. The effect of management practices on manure qualities and runoff pollution potential were compared on 3 feedlot pens with fully surfaced, partially surfaced and unsurfaced conditions. Average N, P and K elements were present in a ratio of approximately 4:1:2 providing 46 lbs. N, 11 lbs. P and 27 lbs. K per ton of dry manure. For recycling purposes ash is an important fraction of manure and can be reduced by use of hard surfaced pens. Ash content averaged 36.2 percent. Fiber and lignin in manure are directly related to the fiber content of the ration. The effect of decomposition of the manure was greatest on its viscosity and squeezability. Bulk density and particle size remained the same. Surfaced feedlot areas have a larger percentage of precipitation in runoff with higher concentrations of pollutants. Increased animal densities on surfaced pens will offset the difference with non-surfaced pens and can result in a lower per-animal pollution potential from runoff. (Hansen-Colorado State)

4068-A6, B2, C1, C2, D3, F1

DEMONSTRATION OF AERATION SYSTEMS FOR POULTRY WASTES

Cornell University, Ithaca, New York 14853
J. H. Martin, Jr. and R. C. Loehr
Environmental Protection Agency Report EPA-600/2-76-186, Oct., 1976, 151 p. 38 fig., 38 tab., 67 ref.

Keywords: Poultry wastes, Biological treatment, Aeration, Odor control, Oxidation ditch, Costs, Nitrogen transformations, Nitrogen losses, Liquid-solids separation, Liquid aeration systems, COD Removal, Sedimentation.

A full scale study demonstrated the potential of aeration systems to reduce the water and air pollution potential of poultry wastes under commercial conditions. The performance of 2 oxidation ditches, each receiving the wastes from approximately 4000 laying hens, was monitored and evaluated. The relationships between 2 design and operational variables and system performance were examined. The variables were level of oxygen supply and solids retention time. It was observed that an oxygen input equivalent to the exerted carbonaceous oxygen demand provided a high degree of odor control. Increase in oxygen supply to also satisfy the exerted nitrogenous oxygen demand resulted in nitrification which terminated ammonia desorption. Subsequent nitrogen losses were the result of denitrification. Relationships between removals of total solids, volatile solids, COD, and organic nitrogen in aerated poultry wastes were developed. Two major problem areas were identified and examined. The first was the removal and concentration of residual solids to maximize oxygen transfer efficiency and minimize the volume of material requiring ultimate disposal. The second was sedimentation of solids in the oxidation ditch channel which reduced and in several instances stopped mixed liquor circulation. (Martin-Cornell)

4069-A2, A4

THE EFFECT OF FEEDLOT RUNOFF ON COMMUNITY STRUCTURE IN THE COTTONWOOD RIVER, KANSAS

N. L. Edwards
M.S. Thesis, Kansas State Teachers College, May, 1970, 25 p. 3 fig., 8 tab., 15 ref.

Keywords: Agricultural runoff, Feedlots, Kansas, Water pollution, Cottonwood River, Neosho River, Benthic fauna, Species diversity analysis.

Water pollution from feedlots has become a serious problem throughout many central and southwestern states due to increase of the concentration of livestock and the number of feedlots. This study exemplifies this situation. Five stations on the Cottonwood and Neosho Rivers in Kansas were sampled periodically from September, 1968, to October, 1969. Benthic invertebrate community structure was subjected to conventional and species diversity analyses. Although there were several possible sources of pollution other than feedlots, feedlot runoff did appear to significantly effect community diversity. This was seen by the decreasing diversity downstream from Station I, by an increase in diversity at those stations farthest downstream from feedlots, and by the higher diversity downstream from Emporia's sewage treatment plant which inferred that the Strong City and Cottonwood Falls domestic effluents had little or no effect on community structure. Additional studies are needed to: (1) pinpoint the various sources of pollution, (2) determine the presence of any significant introduction of drift organisms from tributaries, (3) evaluate the effects of the possible introduction of pollutants from tributaries, and (4) determine the direct effect on community structure of a "slug" moving downstream. (Keel-East Central)

4070-A11, B3, C2, D1, E3, F1

POULTRY WASTE FED TO CATTLE, SHEEP

Anonymous
Wallaces Farmer, V. 102, No. 5, p. 103, March 12, 1977.

Keywords: Refeeding. Dried poultry wastes, Missouri, Cattle, Sheep, Poultry, Nitrogen, Calcium, Phosphorus, Trace metals, Protein, Costs, Economics, Dehydration, Performance, Taste.

Dried poultry wastes (DPW) has been cleared for feeding to Missouri cattle, sheep, and poultry. DPW can be used in ruminant diets for its nitrogen, calcium, phosphorus, and trace metals content. It is generally 25-27 percent protein. The feedstuff value of DPW is $80-$90/ton. It is being produced on a commercial basis by 2 Missouri integrated poultry corporations. DPW is generally processed by heating and dehydrating fresh manure in a rotary dehydrator. Cattle seem to prefer DPW to good corn silage. There are no restrictions on feeding DPW to beef cattle. However, sheep rations are limited to 15 percent DPW and broiler and layer rations are limited to 20 percent and 25 percent, respectively. When properly formulated in the diet, average gain of animals is comparable to gains on conventional livestock feeds. There is no detectable carryover in taste to meat or eggs. Use of DPW as feed will also reduce pollution potential. (Bates-East Central)

4071-A6, B2, B5, C2, E2

GETTING MORE OUT OF LIQUID MANURE

R. Gogerty
Furrow, V. 82, No. 3, p. 10-11, March, 1977. 3 fig.

Keywords: Liquid wastes, Waste disposal, Slotted floors, Deep pits, Soil injection, Irrigation, Fertigation, Land application, Odor, Crop response, Swine wastes.

The productive value of manure as a yield increases depends on how carefully it is stored and applied. Purdue University studies indicate the most efficient system for retaining nutrients in manure is the totally slotted, deep-pit building. Three methods are presented for getting the nutrients into the soil. Injection is the best application method for conserving nutrients. Up to 30 percent more available nitrogen is retained than with surface spreading. Odor is also eliminated. Simon Lehe, who uses this method, says he can produce crops of 60-bushel wheat and 120-bushel wheat with manure as the only source of fertilizer. Disadvantages include longer unloading time, slower decomposition and potentially poor germination of corn planted directly over injection furrows. Irrigation is the low-labor way to handle pit wastes. One man can move the manure in two weeks per year. Conventional handling can take up to two months and requires more compaction. The recommended procedure is rapid plowdown after application because it reduces odors and nearly eliminates nutrient loss. The third method, fertigation, is utilized by Bernard Suplanoski. Liquid swine wastes are applied to preplanted corn land. There is no leaf injury and very little odor problem. Specialists recommend a laboratory analysis to determine the amount of plant food in pit wastes and application near planting time. (Bates-East Central)

4072-B1, C2, D1, D2, D3, E3, F1

FUEL FROM FECES

University of California, Riverside, California
W. C. Fairbank
Paper No. PC 74-03, American Society of Agricultural Engineers, 1974 Pacific Region Meeting, Phoenix, Arizona, 13 p. 2 fig., 1 tab., 5 ref.

Keywords: Fuels, Recycling, Physical treatment, Chemical treatment, Biological treatment, Economics, Anaerobic fermentation, Methane, Organic wastes, Pyrolysis, Hydrogasification, Fertilizers, Land disposal.

The physical, chemical, and biological processes for converting animal manures into gaseous or liquid fuels are being described and bench-tested by many industrial firms and public agencies. Anaerobic fermentation in methane generators for production of methane from organic wastes is one recycling method that has been devised. It has been found expensive and labor intensive. Pyrolysis, the anaerobic decomposition or dissociation of dry manure with heat to produce gas, has been found economically feasible only in arid climates where rapid natural drying to remove the water and arrest decomposition is possible. The economics of hydrogasification of manure into fuel do not seem very good. The economics of scale for a gasification plant considered with the geographical dispersal of livestock do not present a very encouraging opportunity for existing production of patterns. Incineration is not yet a viable alternative. The substitution of manure for commercial fertilizer whenever practical would conserve primary fuel and could be the most effective way to recover energy. The average cost of hauling manure back to nearby land is about $2.00/ton, not including scraping. The average cost of municipal/industrial type solid waste processing is about $4.00/ton. The manure ought to be worth $2.00/ton in fertilizer value. This looks good when compared to a nebulous return somewhere between a debit of $6.00 to a profit of $4.80 for conversion to gaseous fuel. Only the municipal or corporate industry is likely to amass the capital and technical resources needed to convert animal wastes into fuel. (Merryman-East Central)

4073-A3, A4, B2, C2, D1, D2, E2
IMPACT OF HATCHERY WASTEWATER IRRIGATION UPON CONTIGUOUS STREAM QUALITY

Department of Biological and Agricultural Engineering, North Carolina State University, Raleigh, North Carolina 27607
J. C. Barker, F. J. Humenik, M. R. Overcash, F. Koehler, R. Phillips
Paper No. 76-2566, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 8 p. 1 fig., 3 tab., 3 ref.

Keywords: Hatchery wastes, Wastewater treatment, Land application, Irrigation, Agricultural runoff, Nonpoint sources, Water pollution, Sampling, Chemical analysis, Nitrogen, Rainfall, Fescues, Coastal Bermuda grass.

A waste management system was designed for Chick Sales, Inc., Siler City, North Carolina, in which hatchery wastes are taken care of by in-house cleaning and separation processes prior to entry into an extramural septic tank, aerated lagoon and polishing-storage pond series, and a permanent-set irrigation system. The capability of land application via this irrigation system for handling a no-discharge goal is evaluated on the basis of the monitoring of the stream into which the irrigated fescue pasture and the irrigated Coastal Bermuda pasture drained. The following conclusions were drawn: (1) No observed differences at the 0.05 level of significance were indicated in contiguous stream COD, TOC, TKN, NH_3-N and TPO_4 concentrations as a result of rainfall runoff from Coastal Bermuda and fescue pastures irrigated with hatchery wastewater. (2) Although maximum stream impact from nonpoint sources would be expected during runoff events, no significant differences were observed between background and impacted stream reaches when runoff events were examined separately. (3) Land application receiver plots should be designed so that the rate of nitrogen application in wastewater does not exceed crop uptake. (4) Except for the mobile nitrate ion which tends to be released to surface waters during soil-water interflow rather than surface flushing, it appears that nonpoint source sampling and routine chemical analysis is justified only during rainfall runoff events. Furthermore, samples should be collected throughout the entire runoff hydrograph. (Merryman-East Central)

4074-A5, A8, B2, C2, D3
INFILTRATION CHARACTERISTICS FROM ANAEROBIC LAGOONS

New Zealand Agricultural Engineering Institute, Lincoln College, Canterbury, New Zealand
D. J. Hills
Journal Water Pollution Control Federation, V. 48, No. 4, p. 695-709, April, 1976. 7 fig., 7 tab., 26 ref.

Keywords: Anaerobic lagoons, Infiltration rates, Dairy wastes, Groundwater pollution, Soils, Sealants, Sampling, Chemical analysis, Hydraulic gradient, Bentonite, Sodium carbonate, Sodium tripolyphosphate, Nitrates, Ammonia, Chemical oxygen demand, pH, Total solids, Volatile solids

Research was done to augment present information on parameters affecting infiltration rate and quality of infiltrate from anaerobic lagoons and to investigate possible sealing techniques. Twelve pilot-scale anaerobic lagoons treating dairy shed wastes were constructed and operated for a year. Variables were soil type – loam, silt loam, sand loam, and clay loam; pond depth – 2, 3, and 4 m; compacted bottom soil thickness – 15, 25, and 35 cm; and soil additives – bentonite, sodium carbonate, and sodium tripolyphosphate. Infiltration rates were monitored. Samples of the feed, lagoon liquor, and infiltrate were chemically analyzed for nitrate, ammonia and organic nitrogen, chemical oxygen demand (COD), pH, total solids, (TS), and volatile solids (VS). The following conclusions were drawn: (1) Contamination of groundwater with total nitrogen, COD, and TVS from properly constructed anaerobic lagoons is very small. (2) The amount of infiltrate and pollutants increased in the following order of the soil types used: clay loam, loam, sand loam, silt loam. (3) Additives that chemically affect soil structure to produce clogging are of little value in anaerobic lagoon construction. (4) The soil's hydraulic conductivity attained under anaerobic biological conditions seems to be a function of the inverse of the hydraulic gradient. (5) The concentration of pollutants in the infiltrate seems to be a function of the hydraulic gradient. (6) The ultimate sealing mechanism seems to be soil pore clogging that penetrates below the soil surface. Clogging is not solely a surface phenomenon. (Merryman-East Central)

4075-B3, C1, C2, D3, E3
UTILIZATION AND DISPOSAL OF RESIDUE FROM THE PARTIAL OXIDATION OF CATTLE FEEDLOT MANURE

Texas Tech University, Lubbock, Texas 79409
B. H. Kara, R. V. Sweazy, J. E. Halligan, and R. H. Ramsey
Project Report, Texas Tech University, June, 1975, 76 p. 2 fig., 24 tab., 64 ref.

Keywords: Cattle manure, Oxidation, Recycling, Fluidized-bed reactor, Residues, Char, Ash, Chemical properties, Physical properties, Fuels, Fertilizers, Soil conditioners, Adsorption, Coagulation.

Cattle manure was partially oxidized in a small fluidized-bed reactor. Solid residues were collected at 2 different places in the process. Physical and chemical characteristics of char and ash (solid residues) were determined in order to determine their pollution potential and to evaluate their potential uses. These data coupled with results of laboratory scale adsorption and coagulation experiments yielded the following conclusions: (1) Potassium, sodium, calcium, magnesium, phosphorus, silicon, chloride, and sulfate were the major constituents of ash. The specific gravity of ash varied from 2.02 to 2.46 and fusion temperatures ranged from 1,099° C to 1,288° C. Water soluble content varied from 32 percent to 51 percent; pottasium, sodium, chloride, and sulfate being the major soluble constituents of the ash. (2) Analysis of ash prepared from manure samples collected from various locations within 2 different feedlots revealed little variability in physical and chemical characteristics. (3) Prospects of using char as a primary fuel were not encouraging. Its use as a supplemental fuel may be feasible. (4) Char and ash may be disposed of in carefully designed and operated sanitary landfills with little threat of pollution. (5) Manure ash contained 15.06 to 24.10 percent potassium and 6.02 to 6.82 percent calcium, indicating potential as fertilizer and soil conditioner. However, the high sodium content of ash may not make this feasible. (6) Ash and char were found to have appreciable color adsorbing capability. (7) Though the use of ash with aluminum sulfate in coagulation tests resulted in slight turbidity decrease relative to aluminum sulfate alone, the reduction was not great enough to warrant the use of ash as a coagulant-aid. (8) Composition of manure ash and its high percentage of soluble components indicate that its use as an admixture in cement, concrete, or lime may not be feasible. Further research concerned with possible uses of char and ash needs to be done. (Merryman-East Central)

4076-B2, E2, F1
IRRIGATION: ONE WAY TO HANDLE LAGOON WASTES

Anonymous
Wallaces Farmer, V. 102, No. 7, p. 110-111, April 9, 1977. 1 fig., 2 tab.

Keywords: Irrigation systems, Liquid wastes, Lagoons, Design, Economics, Advantages, Disadvantages.

Increased confinement feeding plus strict waste disposal regulations are causing some livestock producers to adopt irrigation as a way of handling liquid lagoon wastes. Wastes are pumped from the lagoon into a main line and then to a sprinkler or surface irrigation system. Most sprinkler systems for outdoor feedlot runoff or lagoon effluent can use a single-stage, standard centrifugal pump. Undiluted manure with about 15 percent solids requires an open impeller chopper pump. Manure with 20 percent solids requires a trash handling centrifugal pump. Manure with 25 percent solids takes a diaphragm or helical screw pump. Two main types of pipe may be used -- polyvinyl-chroride (PVC) and aluminum. PVC pipe resists corrosion and has less pressure loss but sometimes has plugging problems. It also deteriorates from sunlight if unprotected. Aluminum pipe is more portable, is more resistant to cracking and mechanical damage, and is not affected by sunlight. But, in low pressure systems, it costs more than PVC pipe. Sprinklers generally have 1 to 3 nozzles which vary in size. Small sprinklers may cost about $10, while a gun-type sprinkler runs from $100 to more than $500. The most basic sprinkler system is the handmove system which has high labor requirements. The towline system is similar but includes stronger, more permanent couplers between the lateral pipe sections. Laterals are pulled to locations with a tractor, reducing labor. A stationary big gun is similar to the handmove system but uses one big revolving sprinkler instead of several smaller ones. This system requires more pressure. The towed big gun has the non-plugging advantage of the larger nozzle, and the low labor requirement of the towline. The traveling big gun system is used mainly by very large livestock feeders. A large single nozzle is mounted on a running gear and pulled across the field by a cable attached to a winch. Labor is reduced to a minimum, but investment is high. (Merryman-East Central)

4077-A8, B3, C2, E2

STATUS OF SEDIMENT FROM CATFISH PRODUCTION PONDS AS A FERTILIZER AND SOIL CONDITIONER

School of Agriculture and Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois 62901
D. P. Satchell, S. D. Crawford, and W. M. Lewis
Progressive Fish-Culturist, V. 37, No. 4, p. 191-193, Oct., 1975. 1 fig., 1 tab., 6 ref.

Keywords: Fertilizers, Soil conditioners, Crop response, Catfish production, Sediment, Nitrogen, Phosphorus, Potassium, Organic content.

In evaluating the fertilizing and soil conditioning potential of sediment from catfish production ponds, it was determined that the sediment can be classed as a rich soil. The failure for a buildup of organic material and nutrients to a very high level indicates that the waste from the fish is rapidly and completely broken down and thus does not accumulate as a rich manure. Evaluation of the sediment involved chemical analysis of phosphorus, nitrogen, potassium and organic content. Growth response of 31 Kentucky fescue lawn plots was measured to determine slow release nitrogen. In addition to the fescue plots, pond sediment was furnished to 3 experienced gardeners for observation as to its value in gardening. Chemical analysis of the sediment yielded the following average values: organic matter 4.04 percent, total nitrogen 0.27 percent, total phosphorus .011 percent, extractable phosphorus 1.5 ppm, and extractable pottasium 20 ppm. The plots treated with pond sediment were similar to the control plot throughout the summer, but showed an increased growth of grass during November. Change in color of the grass was not detectable. The 3 gardeners reported improved seed sprouting and superior growth in the first few weeks after planting. Two of the 3 gardeners reported that the sediment eliminated a need for the addition of fertilizer to the soil. None of the three reported a week problem associated with the sediment. (Merryman-East Central)

4078-B2, B3, B4, C2, D3, E2, F1

SYSTEMS ANALYSIS OF ANIMAL WASTE HANDLING ALTERNATIVES

Agricultural Engineering Department, Cornell University, Ithaca, New York
L. M. Safley, Jr. and D. R. Price
Paper No. 76-5537, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 13 p. 2 fig., 3 tab., 8 ref.

Keywords: Computer models, Waste management, Dairy manure, Costs, Labor, Energy, Nitrogen, Land disposal, Waste storage.

A computer program was developed to model dairy manure handling systems. A network was used to describe some of the available possibilities. Input defining particular farm situations was to be supplied by the user. For each system in the network, the model determined its appropriate initial cost, annual fixed cost, quantity of labor required, amount of electricity and diesel fuel needed, the quantity of nitrogen effectively reaching the field, and the annual system cost. This model can be an effective tool for determining the appropriate manure handling system for a particular situation. (Safley-Cornell)

4079-A4, A5, A8, A12, B1, C2, E2

LAND AS A WASTE MANAGEMENT ALTERNATIVE

R. C. Loehr, ed.
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, 811 p.

Keywords: Waste management, Land disposal, Animal wastes, Sewage, Industrial wastes, Environmental impact, Public health, Crop response, Water pollution, Groundwater pollution, Water pollution, Regulation, Nitrogen, Phosphorus, Heavy metals.

This book emphasizes environmental impacts, health aspects and the chemical transformations that occur in land used for waste disposal. A discussion is given of such topics as the rate of toxic materials build up in soil, resulting crop response, water and groundwater pollution, and the transformations of nitrogen, phosphorus and heavy metals. Regulatory aspects are considered. Case histories of land application of sewage are given. Land application of industrial wastes is also considered. (Merryman-East Central)

4080-A2, A3, A4, B1, E2, F2

ECONOMIC AND REGULATORY ASPECTS OF LAND APPLICATION OF WASTES TO AGRICULTURAL LANDS. PROVISIONS APPLICABLE TO ANIMAL WASTES

U.S. Department of Agriculture, East Lansing, Michigan
J. B. Johnson and L. J. Connor
Land as a Waste Management Alternative, Proceedings, of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 30-31.

Keywords: Regulation, Federal Water Pollution Control Act Amendments of 1972, Feedlots, Point sources, Nonpoint sources, Permits, Livestock, Poultry, Land disposal, Agricultural runoff.

Section 306 of PL 92-500 (the Federal Water Pollution Control Act Amendments of 1972) identifies ''feedlots'' as a category of point source dischargers. Section 402 of PL 92-500 provides permit requirements for point source dischargers, and Section 301 specifies the general outline for the development of effluent limitations guidelines applicable to industrial categories of point source dischargers. Environmental Protection Agency announcements indicate that the ''feedlots'' subject to permit requirements and effluent limitations guidelines are concentrated livestock and poultry operations. Feedlots with capacities of 1000 head or more and a discharge are required to obtain permits; those with 300- to 1000-head capacity discharging into surface waters through a man-made conveyance or with waters coming in contact with the feedlot are required to obtain a permit; and under limited conditions, certain feedlots of less than 300-head capacity must obtain a permit. Effluent limitations guidelines for these recently issued EPA permit requirements have not been announced. Section 304 to PL 92-500 calls for development of guidelines for identifying and evaluating the nature and extent of nonpoint sources of pollutants and processes, procedures and methods of control of such pollution. Land application of animal wastes is included in the initial group of potential agricultural nonpoint sources of water pollution identified by EPA. General sources of animal wastes applied to land are: (1) wastes removed from feeding and/or holding facilities, (2) runoff and other discharges controlled from animal production facilities, and (3) animal excretion on pasture and rangeland. Methods and procedures to limit the water pollution potential of animal wastes applied to land have been announced by EPA. (Merryman-East Central)

4081-A8, B1, B5, C2, E2, F1

THE ADMISSIBLE RATE OF WASTE (RESIDUE) APPLICATION ON LAND WITH REGARD TO HIGH EFFICIENCY IN CROP PRODUCTION AND SOIL POLLUTION ABATEMENT

Institut fur Pflanzenbau und Saatgutforschung, Forschungsanstalt fur Landwirtschaft, Braunschweig-Voelkenrode, Germany
C. Tietjen
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 63-77. 5 fig., 5 tab., 15 ref.

Keywords: Land application, Livestock wastes, Municipal wastes, Industrial wastes, Germany, Legal aspects, Regulation, Crop response, Nutrients, Costs.

Development and operation of waste management programs require decisions based on costs, environmental factors, resource conservation and institutional factors. In Germany, specific institutional factors that apply are: the 1972 law of waste disposal, the 1957 (1976) law of water resources, and the causer principle (a principle which provides the basis for regulations to define the source of pollutants and to charge the responsibility for maintaining or improving a given state and balance in the environment). The German law of waste disposal distinguishes clearly between livestock wastes and municipal and industrial wastes. While livestock wastes are regarded as manure if the ratio of available land and manure livestock units is reasonable (3 manure livestock units/ha), the other groups of wastes remain in the control of the law even if utilized as manure for crop production. The order for reuse of minicipal and industrial wastes in crop production, which is being developed according to the law of waste disposal, will provide for decreasing potential health hazards and environmental pollution hazards. Wastes which do not fit the aim of soil improvement and crop nutrition are excluded from consideration. A long list of industrial wastes which are unsuitable for crop production will be annexed to the order. Application of municipal wastes to croplands may require additional fertilizer applications to balance the ratio of major nutrient elements and trace elements necessary for optimal crop production. Wastes are suitable for use in crop production only if the content of major nutrients is high, content of trace nutritive elements is low, and content of predominantly toxic elements is still lower. A restriction is necessary for a random sample survey, control of the waste source, and regular soil testing in order to prevent concentration of disadvantageous elements in the soil from exceeding tolerable levels. (Merryman-East Central)

4082-A8, A11, B1, B5, C2, E2

MONITORING SEWAGE SLUDGES, SOILS AND CROPS FOR ZINC AND CADMIUM

Department of Agronomy, The Pennsylvania State University, University Park, Pennsylvania
D. E. Baker, M. C. Amacher and M. T. Doty
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 261-281. 1 fig., 11 tab., 42 ref.

Keywords: Zinc, Cadmium, Toxicity, Animal health, Crop response, Food chain, Livestock, Poultry, Sewage sludge, Soils, Rations, Monitoring.

An attempt is made to provide perspective to problems of monitoring sewage sludges, soils, and crops for zinc and cadmium and to present research results that aid in establishing approaches and standards for protecting the food chain (including livestock and poultry) from unsafe accumulations of cadmium. The following conclusions were drawn: (1) Additions of wastes containing only 5 to 10 ppm cadmium (Cd) can be expected to increase the concentrations of Cd within the food chain over time. (2) Manure concentrations of cadmium are about 2.3 times as high as those of the animal ration. (3) Sludge composition from different treatment plants over time varies with respect to zinc and cadmium, from 15 to 100 percent of the mean. A variation of 50 percent should be expected. (4) In one study, maintenance of less than 1 ppm Cd in leaves of corn, sorghum and soybeans required a loading capacity of 0.5 ppm per year or 1 ppm Cd within the soil over a 2-year period. (5) 0.1 N HC1 extractant removed most of the cadmium and more than 50 percent of the zinc added with sludge to the soil. DTPA removed about 30 percent of the zinc and 60 percent of the cadmium added over 2 growing seasons. (6) The Baker method extracts zinc and cadmium in relation to their availability, and their activities in testing solutions reflect the relatively high activity and biological availability of cadmium compared with zinc. (7) For controlling cadmium within the food chain, sludge applied as a source of nitrogen for corn should not contain more than 33 ± 17 ppm Cd; the labile cadmium within the soil should not exceed 1 ppm, and pCd by the Baker method should not be lower than 12.0. (8) Soil levels of zinc should not exceed levels associated with a zinc toxicity in plants. (9) Mole fractions of zinc on the adsorption complex are expected to reflect levels of zinc that are phytotoxic. (Merryman-East Central)

4083-A4, A5, A8, A9, A10, A11, A12, B2, B5, C2, C3, D1, D2, D3, E2

HEALTH HAZARDS OF AGRICULTURAL, INDUSTRIAL, AND MUNICIPAL WASTES APPLIED TO LAND

Institute of Animal Medicine and Animal Hygiene, University of Hohenheim, Stuttgart, Federal Republic of Germany
D. Strauch
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 317-342. 7 fig., 10 tab., 34 ref.

Keywords: Confinement pens, Animal health, Public health, Diseases, Toxicity, Pathogenic bacteria, Nitrates, Phosphates, Land disposal, Water pollution, Groundwater pollution, Slurries management, Antibiotics, Industrial wastes, Sewage, Sewage sludge, Hygiene, Chemical treatment, Biological treatment, Physical treatment.

Confinement of animals has increased the number of latent infections in animal production all over the world. The adoption of slurry systems for handling wastes is charged as being largely responsible for this situation. Infective agents occur in the liquid manure and survive the usual storage time. When the slurry is disposed of on pasture lands, infections may be transmitted to livestock. For an effective interruption of the infection cycles, hygienic on-site treatment of infectious slurry may be necessary before land disposal of the wastes. An additional danger to public health arises when too large amounts of slurry are distributed on land. Pollution of surface and groundwaters may arise due to infective agents, phosphates, and nitrates. Another hygienic risk for men and animals is the occurence of transmissible resistance of microorganisms caused by feeding antibiotics to improve growth in animal production. Use of newly developed substances which are not resorbed and are said not to cause resistance may solve this problem. Land disposal of industrial wastes may result in toxic organic and inorganic substances which may enter the food chain. High concentrations in plants and food derived from animals can be a health hazard for animals and man. Consequently, the maximum concentrations in soil and plants should be determined and routinely controlled. Land disposal of infected sewage and sewage sludge can cause infections of animals and man. Sewage and sludge should be disinfected before being applied to the land. If this is not feasible, the wastes should only be disposed of on arable land and not on pastures and other green fodder areas. Because sewage and sludge also contain undesired chemical compounds which may be hazardous to animals and man, the same control measures as for the land use of industrial wastes should be employed. (Merryman-East Central)

4084-A3, A4, A5, A8, A11, A12, B1, C2, C3, E2

MICROBIAL CONCERNS WHEN WASTES ARE APPLIED TO LAND

U. S. Department of Agriculture, Lincoln, Nebraska
J. W. Doran, J. R. Ellis, and T. M. McCalla
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 343-361. 1 fig., 7 tab., 47 ref.

Keywords: Land disposal, Soil microbiology, Animal wastes, Sewage, Pathogenic bacteria, Water pollution, Groundwater pollution, Ammonification, Nitrification, Denitrification, Mobilization, Methylation, Volatilization, Trace elements, Toxicity.

As a result of implementation of the National Environmental Policy Act of 1969 and, more specifically, the respective amendments for the Clean Air Act and Federal Water Pollution Control Act of 1970 and 1972, land application seems the most feasible means of disposing of animal wastes and domestic sewage wastes. Disease transmission due to this practice is no problem if the wastes have been adequately treated, applied to the land at acceptable rates, and applied in such a way that rapid percolation and runoff are minimized. However, surface and groundwaters should be monitored frequently for indications of fecal contamination in areas where wastes are applied to land. An important concern in assessment of land application of wastes is the effects of disposal practices on microbial processes of decomposition and nutrient cycling. Excessive loading of soils with waste materials will result in oxygen depletion, slower decomposition, and accumulation of odorous, phototoxic end products that may reduce soil productivity. Proper loading of organic wastes in the soil can result in optimal balance between nitrogen removal and reduction in pollution. The stimulation of microbial methylation by wastes added to the soil may be of importance because this transformation can result in the mobilization of many toxic trace elements through volatilization. (Merryman-East Central)

4085-A8, C3, E2

PATHOGEN SURVIVAL IN SOILS RECEIVING WASTE

Department of Microbiology, Colorado State University, Fort Collins, Colorado
S. M. Morrison and K. L. Martin
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 371-389. 3 tab., 102 ref.

Keywords: Land disposal, Microorganisms, Pathogenic bacteria, Literature review, Pathogen survival.

In compiling this literature review, it was found that a great deal of variability exists in the reported information on survival of organisms when they are applied to soil or when laboratory simulations of this process are tested. A great number of variables control the results and create some difficulty in comparing results; these hard-to-control variables may have had a limiting effect on the research that has been done. Many factors regulate the longevity and pathogenicity of microorganisms. Many microorganisms die rapidly when placed in the biologically competitive and physically and chemically hostile environment of the soil. The soil is especially hostile to organisms that are specialized and adapted to the temperature and nutrition of host cells and organs in which they produce disease. Moisture is probably the largest single factor in determining length of survival. Temperature, the nature of the receiving soil, the organism inoculum size, the type and condition of the cells, sunlight, and antagonistic biological and chemical agents of the soil-waste mix all play a role in the survival of the microorganisms. The variations in survivability observed in this literature review certainly accentuate the lack of adequately controlled experiments so that one factor at a time might be evaluated. Recommendations are listed which, if adhered to, would reduce the possibility of transmission of disease agents as a result of land disposal. (Merryman-East Central)

4086-A5, A8, B2, B5, C2, D3, E2

CONTINUOUS SUBSURFACE INJECTION OF LIQUID ORGANIC WASTES

Department of Agricultural Engineering, Colorado State University, Fort Collins, Colorado
J. L. Smith and D. B. McWhorter
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 643-656. 7 fig., 5 tab., 8 ref.

Keywords: Land disposal, Liquid wastes, Sludge, Dairy wastes, Sewage, Subsurface injection, Sampling, Soils, Crops, Groundwater pollution, Nitrogen, Heavy metals.

The effects of a subsurface injection system on soils, crops, and groundwater were examined. The injection system studied as a seven-sweep unit capable of injecting up to 8 percent solids material at rates up to 3,000 liters per minute.

Three sites were studied. The Boulder, Colorado site received anaerobically digested sludge from a waste treatment plant. The Williamsburg, Virginia site received wastes from a treatment plant which treats domestic sewage and wastewater from the Anheuser-Busch Brewery in Williamsburg. The third site, near Timnath, Colorado, received wastes including washwater and manure from a 125-cow dairy. Soils, crops, leachates and groundwater were sampled at the sites. Control of soil salinity was a minor problem at the Boulder site and a major problem at the manure application site. It was impossible to correlate the application of wastewater residuals with a measured buildup of heavy metals in the soil at any of the sites due to difficulty in securing representative soil samples and, perhaps, due to chemical analysis procedures. A mass balance approach was used to predict changes in the levels of potential contaminants in the soil and groundwater. Although there was considerable variability in data, a definite correlation was found to exist between nitrogen leachate concentration and application of sludge. Leachate nitrogen levels in Williamsburg and at the manure site ranged from 3 to 30 mg/1. No statistical correlations could be established between application of any of the materials and groundwater quality. An analysis was made of sweet corn grain and tissue samples grown on a plot treated with 65,000 dry kg/ha sludge. All values were within the range found in the literature for field corn grown on untreated soils. This was true for 2 consecutive years. (Merryman-East Central)

4087-A6, A8, B2, B5, E2

ENGINEERING DESIGN CRITERIA FOR SLURRY INJECTORS

NCAE, Silsoe, Bedford, England
R. J. Godwin, E. McKyes, S. Negi, G. V. Eades, J. R. Ogilvie, and C. Lovegrove
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 657-671. 10 fig., 2 tab., 18 ref.

Keywords: Design, Slurries, Soil injection, Tine injectors, Equations, Soil forces, Odor control.

Because simple tine injectors that thus far have been developed for incorporating wastes into the soil are felt inadequate, a new look is taken at injector design. Consideration is given to agronomic and environmental requirements, the volumes of soil that must be disturbed, and the soil forces acting upon the injector. In general, waste slurry should be placed as near as is practical to the soil surface in order to spread the aerobic stabilization of the organic material. In addition to providing a cavity of sufficient volume to contain the applied slurry as soon as the liquid is delivered, the injector must also cause soil to be disturbed so that new voids will be created to incorporate the slurry. The geometry of an injector should be selected to provide the desired disturbed area, while having the minimum soil reaction forces for operation. Equations were developed for coping with these factors. It was determined that obtaining a given disturbed soil volume with minimum draft force required the use of a wide injector working at a shallow depth. However, limits are placed on the width of an injector by (a) the damage to roots in grassland and row crops, and (b) the distribution and flow of slurry from an aperture with a large width and small height. Consequently, it was found desirable to limit the example injector design to a width of 10 or 12 inches, leaving 9-10 inches clear between the injector edge and the crop rows. A prototype injector based upon the design criteria was constructed with a rake angle from the horizontal of 30° and a side sweep angle of 60° from the axis of travel. This device was used in preliminary trials, injecting 200 gal/min of swine manure slurry, having approximately 10 percent solids, into several different soil types and sod, including ground frozen to a few inches depth. Good incorporation of the slurry was observed except in the frozen soil. Proper soil cover and odor absorption were observed. An exhaustive series of field tests is planned, including the injection of slurries of different consistencies into many different soil and crop conditions. (Merryman-East Central)

4088-A8, B2, B5, C2, E2

OVERLAND RECYCLING OF ANIMAL WASTE

Alcorn State University, Lorman, Mississippi
H. E. Grier, W. Burton, and S. C. Tiwari
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 693-702. 1 fig., 9 tab., 4 ref.

Keywords: Waste treatment, Waste disposal, Overland spray irrigation, Crop response, Soil water, Sampling, Chlorides, Nitrates.

In 1972, a three-year study was initiated to evaluate the technical and economical aspects of treating and disposing of swine wastes by means of an overland spray irrigation for crop production and effluent improvement. The site selected for use in this study was 1450 ft from the swine-feeding facility and lagoon area. Three 0.3-acre demonstration fields were provided along with a 117.6 x 83 ft research area for 4 replications of 3 treatments spraying 0.2 in. water, 0.1 in. water with 0.1 in. effluent, and 0.2 in. effluent per application at various weekly frequencies. A significant difference in change of pH by overland spray was noted when aerobic effluent was sprayed overland at all application rates. There were no significant differences in change of nitrate concentration when aerobic effluent was sprayed overland due to depth of penetration through the soil. Water sprayed overland gave the least change in chloride content of soil water after treatment. There were significantly greater changes in chloride content of soil water after treatment with 0.1 and 0.2 in. of aerobic effluent per application. Significant differences in change of chloride content due to depth were noted. There were no significant differences in changes of nitrate concentration when aerobic effluent was sprayed overland due to depth of penetration through the soil. Nitrate-N ion concentration increased significantly when both levels of aerobic effluent containing 12.00 mg/1 was sprayed overland. (Merryman-East Central)

4089-A8- B1, B5, C2, E2

SOIL AND CROP RESPONSE TO APPLIED ANIMAL WASTE

Water Resources Institute, South Dakota State University, Brookings, South Dakota
M. L. Horton, R. R. Schnabel, and J. L. Wiersma
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 703-712. 2 fig., 6 tab., 11 ref.

Keywords: Land application, Crop response, Soil analysis, Application rates, Salt supplemented diets, Electrical conductivity, Infiltration rates.

A study was conducted to investigate the effects of applying various rates of animal wastes (from animals receiving salt supplemented diets) upon soil properties and crop production under subhumid conditions where minimum amounts of leaching water are available. The study was initiated in August, 1973. A feeding trial was conducted which consisted of 8 pens of beef steers in confinement and 8 pens in the open with no shelter. Four levels of salt (0, .25, .50, and .75 percent of the ration on a dry-weight basis) were added to a common basic ration. All wastes were collected, held in storage until time of application, and applied to field disposal plots at 4 rates (44.8, 89.6, 139.4, and 179.2 MT/ha). The applied wastes consisted of 2 salinity levels – low (combined wastes from pens receiving 0 and .25 percent added salt) and high (combined wastes from pens receiving .50 and .75 percent added salt). Sodium content of wastes varied directly according to amount of salt added to diets. The first year's application of waste increased the electrical conductivity (EC) of the surface 30 cm of soil under all treatments. At rates of 89.6 MT/ha or greater, sufficient salts were added to increase the EC to values in excess of 4000 μmhos/cm for the surface 30 cm. After the second year of waste application, the entire root zone of plots receiving the wastes were saline. Exchangeable sodium of the soil increased wth an increase in the amount of salt added; however, the increase was not as great for the second year of application. There was no significant difference in 1974 silage yields between salt levels nor among waste rates. The 1975 silage yield data showed no significant difference between salt levels; however, among waste rates the yields were significantly different at the .05 level. 1974 corn yield data were significantly different among waste rates at the .05 level. Applications of animal waste in excess of 90 MT/ha caused reduced infiltration. (Merryman-East Central)

4090-A8, B2, B3, B5, C2, E2

SALT ACCUMULATION IN SOIL AS A FACTOR FOR DETERMINING APPLICATION RATES OF BEEF-FEEDLOT MANURE AND LAGOON WATER

Northwest Experiment Station, Crookston, Minnesota
G. W. Wallingford, W. L. Powers, L. S. Murphy, and H. L. Manges
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 713-726. 8 fig., 2 tab., 10 ref.

Keywords: Application rates, Manure, Lagoon water, Irrigation, Salinity, Kansas, Electrical conductivity, Soil analysis, Sodium, Potassium, Calcium, Magnesium, Toxicity, Crop response.

In separate studies, beef feedlot manure was applied in the fall and beef feedlot lagoon water was applied by furrow irrigation during the summer, on a silty clay loam soil in south-central Kansas. Surface soil samples (0 to 15 cm) were taken from each plot in the spring and fall. In the fall of 1973, soil cores were taken to a depth of 3 m from plots in 2 of 4 replications in both the manure and the lagoon-water studies. The surface and the soil core samples were analyzed for soluble salts. The electrical conductivity (EC) of the extract was measured. Concentrations of sodium, potassium, calcium, and magnesium in the extract were measured. Good correlation between surface soil EC and application rate suggested that EC measurements could be used as a management tool to monitor the salt status of fields receiving manure or lagoon water. In soil cores, EC was increased in the top 2 meters by the higher rates of lagoon water and manure. In the surface soil and in the upper sections of the soil cores, and meq/1 percentage of potassium increased with increasing rates of both lagoon water and manure. The meg/1 percentage of Ca decreased with increasing rates. At high application rates, more calcium than potassium was removed from the soil solution. Saturation extracts below 20 cm did not change in percentage composition in lagoon-water or manure studies. Toxic salt accumulations in soils can result in reduced plant growth. Guidelines for recommending manure application rates, based on salt balance calculations require knowledge of salt composition of wastes, the tolerable salinity in the soil, the salt content of any irrigation water added, the soil texture, and the amount of salt leaching expected from natural precipitation. (Merryman-East Central)

4091-A3, A4, B5, C2, E2, F1, F2

ECONOMIC POTENTIAL AND MANAGEMENT CONSIDERATIONS IN LAND APPLICATION OF BEEF FEEDLOT WASTE

Department of Agricultural Economics, Oklahoma State University, Stillwater, Oklahoma
D. D. Badger
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 727-742. 5 tab., 13 ref.

Keywords: Land application, Feedlots, Cattle manure, Nutrients, Application rates, Economics, Legal aspects, Water pollution, Nonpoint sources.

New guidelines related to reducing water pollution from nonpoint sources are being implemented for Section 208 of PL 92-500, the Federal Water Pollution Control Act Amendments of 1972. The way these Section 208 regulations are implemented will have a significant impact on future application of both solid and liquid beef feedlot wastes to crop and pastureland. Recently, farmers have returned more and more to feedlot wastes as a source of nutrients. High fertilizer prices have made use of feedlot wastes more economically viable. While manure nutrients are highly variable, farmers realize that manure use provides additional benefits. Moisture intake and water-holding capacity of sandy and loam type soils is improved. Texture or tilth of soil is improved. The appearance or "richness" of light-colored tight soils is improved. Problems resulting from manure use have been: compaction of soil due to large, heavy trucks that deliver and spread manure, slower rate of application compared to commercial fertilizer application, the necessity of working the field one to two times more to incorporate manure into the soil, unevenness of application, imbalance in ratio of nutrients applied relative to soil needs, increased salinity, and introduction of weeds. In the Oklahoma and Texas Panhandle areas, a general rule of thumb for manure application has been that manure may be applied safely for several consecutive years at 10 tons/acre/year. Most farmers surveyed in the Panhandle areas were convinced that the nutrient value of beef feedlot wastes was sufficiently high to pay the current rate of $3.00 to $3.50 per ton of manure. Engineering design and economic feasibility studies are needed to determine more efficient methods of storing, transporting and applying beef feedlot wastes, to retain a higher percentage of the nutrients for cropland use than is now the case. There appears to be a real need for some research on how to measure the trade-offs involved as well as to find mutually acceptable solutions for cropland utilization of manure and for minimizing runoff to comply with Section 208 of PL 92-500. (Merryman-East Central)

4092-A3, A8, B2, E2

CONTINUOUS WATERSHED MODELING OF WASTEWATER STORAGE AND LAND APPLICATION TO IMPROVE DESIGN PARAMETERS

Department of Agricultural Engineering, Kansas State University, Manhattan, Kansas
J. A. Anschutz, P. K. Koelliker, J. J. Zovne, T. A. Bean, and W. H. Neibling
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 783-796. 3 tab., 21 ref.

Keywords: Computer models, Wastewater storage, Land application, Design, Feedlots, Agricultural runoff, Weather, Soil moisture, Evaporation, Evapotranspiration.

The best and most physically based processes and input parameters from various disciplines have been drawn together into a model specifically adapted to the feedlot simulation. Model components are the feedlot surface, wastewater storage facility, disposal system, and disposal/treatment area. The movement of wastewater into and out of, as well as the amount stored in each component, is estimated each day. The model has been run for 3 stations -- Topeka, Kansas, Garden City, Kansas, and Corvallis, Oregon. A printout of each year's annual summary has estimated the effectiveness of the management practices specified in controlling feedlot runoff at each specific site. Inflows and outflows of the storage facilities are listed by months and have units of inches over the disposal areas. Water balance in the disposal area lists the inputs, outputs, and change in soil moisture in inches in the disposal area. The percent of feedlot runoff controlled is listed indicating the effectiveness of the specified management practice in controlling feedlot runoff for the particular year. Results are given for the 3 stations. Three different pond sizes were specified at each location. Comparisons of the 3 locations indicate that different design criteria are required to control discharges of feedlot runoff. Garden City had the least average annual runoff and required the smallest sized pond to effectively control all runoff. Garden City also had the largest number of disposal days due to less precipitation than the other 2 areas. An attempt is being made to develop the model so that it can ultimately receive as many input parameters as possible. The model can then be site-specific. (Merryman-East Central)

4093-A4, A6, A8, A12, B1

WASTE MANAGEMENT PROBLEMS AND THEIR IMPACT ON THE ENVIRONMENT. ANIMAL WASTE MANAGEMENT

Czechoslovak Research and Development Centre for Environmental Pollution Control, UNO/WHO Programme, Bratislava, Czechoslovakia
I. Fratric and E. Parrakova
Land as a Waste Management Alternative, Proceedings of the 1976 Cornell Agricultural Waste Management Conference, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1977, p. 804-805.

Keywords: Czechoslovakia, Waste management, Air pollution, Water pollution, Public health, Bacteria.

Czechoslovakians have found that large-scale animal breeding results in the concentration of a great number of animals within a limited space with frequent replacement of generations, the operation being maintaned by a minimum number of workers with the application of mechanization, automation and with a maximum use of high-value feeds. A seminar was held in Bratislava in September, 1975 to consider the following topics: large-scale animal industry and environmental quality, technologies for processing animal wastes, utilization and disposal of animal wastes, and economic aspects of animal waste management. Large-scale technology of breeding contaminates the environment, mainly the soil and the air, by increasing the frequency of resistant strains of E. coli. (Merryman-East Central)

4094-A4

NATURE AND IMPACT OF STREAM INPUTS ON A WATERSHED BASIS

Department of Biological and Agricultural Engineering, North Carolina State University, Raleigh, North Carolina 27606
F. J. Humenik, M. R. Overcash, F. Koehler, L. Bliven, and W. S. Galler
Paper No. 76-2564, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 14 p. 7 tab., 7 ref.

Keywords: Rural runoff, Agricultural runoff, Water pollution, Statistical survey, Chowan River, Sampling, Chemical analysis, Algae.

A statistical survey of small subbasins in the Chowan River watershed was made to determine the feasibility of making areawide assessments of the magnitude and impact of rural runoff. Fifteen subbasins were randomly selected to study the potential of stratified random sampling as a monitoring strategy. The basin was stratified on the basis of soil-topographic-land use factors. The 4 strata chosen were: (1) poorly-drained Coastal Plain; (2) well-drained Coastal Plain (W); (3) agricultural Piedmont; and (4) silvicultural Piedmont. Continuous monitoring and grab sampling results were compared at 5 sites. Long-term averages were found to be similar for the total basin, but individual runoff events had more impact on concentration and transport, especially at sites with human intervention. (Merryman-East Central)

4095-A8, B1, B5, C2, E2, F1

A SYSTEM OF OPTIMIZING THE USE OF ANIMAL MANURES ON A GRASSLAND FARM

Agricultural Institute, Dublin, Ireland
V. A. Dodd, D. F. Lyons, and P. D. Herlihy
Journal of Agricultural Engineering Research, V. 20, No. 4, p. 391-403, Dec., 1975. 7 fig., 2 tab., 5 ref.

Keywords: Mathematical models, Linear programming, Grass production, Swine wastes, Poultry wastes, Fertilizers, Economics.

A mathematical model based on linear programming techniques was developed to optimize the use of animal manures for the production of conserved grass. The following factors were taken into account: the nutrient content of animal manures, the nutrient requirements of the crop, and the necessity of preventing excessive accumulation of nutrients in the soil or the crop. Application of this model is illustrated by an example using June, 1974 prices of chemical fertilizers and a range in sale values of pig and poultry manures from zero to their theoretical cash value. The study indicated that there is considerable potential to reduce the consumption of chemical fertilizers by the optimum utilization of animal manures for grass production. (Merryman-East Central)

4096-A3, A4, B1

EPA WILL USE KSU MODEL AS WASTE CONTROL SYSTEMS TOOL

Anonymous
Kansas Farmer, V. 113, No. 20, p. 39, Nov. 20, 1976.

Keywords: Environmental Protection Agency, Kansas State University, Water quality index, Computer models, Feedlots, Water pollution, Watersheds, Agricultural runoff, Design, Waste management, Rain, Snow.

The Environmental Protection Agency has given Kansas State University a $108,556 grant as a first step in EPA's program to develop a complete water quality index for feedlots -- an index which will show that pollutants are in the water, where the water goes, and what effects pollutants might have on the environment. Kansas State University scientists are developing a computerized watershed model to predict the effects of rain and snow on the waste control systems of feedlots. The model will be used by EPA to evaluate waste control systems of feedlots. KSU research may also be helpful in designing new cattle feedlots. By using a computerized model, a representation is given of how different systems might work. This would be a definite boon in selecting the best design for particular feedlots. (Merryman-East Central)

4097-A2, B2, B4, B5, C2, E2

DILUTION OF FEEDLOT RUNOFF

Texas Agricultural Extension Service, Texas A&M University, College Station, Texas
J. M. Sweeten
MP 1297, Great Plains Beef Cattle Handbook, GPE-7522, 1976, 7 p. 13 fig., 1 tab., 5 ref.

Keywords: Soil management, Agricultural runoff, Holding ponds, Land disposal, Nutrients, Salinity, Sodium, Potassium, Calcium, Magnesium, Sulfates, Chemical Analysis, Dilution, Crop response.

Guidelines are given for feedlot operators who dispose of effluent stored in feedlot runoff holding ponds on agricultural lands. While holding ponds contain beneficial nutrients like nitrogen, phosphorus, and potassium, they also contain salts of sodium, calcium and magnesium which can create unproductive soil if applied excessively. Salt accumulation from holding pond water is likely to occur in areas where precipitation is not adequate to leach the salts downward below the root zone. Guidelines for diluting holding pond water to minimize the chance of reducing the land's productivity are given. Holding pond water should be analyzed for chemical content at least twice a year. The land receiving the water should be analyzed for chemical content at least twice a year. The land receiving the water should also be analyzed. Records should be kept of these analyses. In addition to salt, holding pond water with an improper balance of sodium plus potassium in relation to calcium and magnesium salts may cause the soil aggregates to disperse into individual particles, reducing water infiltration. Recommended maximum sodium plus potassium percentages for various soil textures and risk levels are given. Excess sulfates can also encourage conditions that cause undesirable soil dispersion. If electrical conductivity of the soil water extract approaches 4 to 6 mmhos/cm (4,000 to 6,000 umhos/cm), depending on the soil salinity level chosen; if crop growth is reduced; or if water stands in the field longer than usual, professional advice is needed on further soil management steps. (Merryman-East Central)

4098-A11, B3, C2, E3

COMPLETE RATIONS FOR DAIRY CATTLE. VII. DRIED POULTRY WASTE FOR LACTATING COWS

Dairy Science Department, University of Florida, Gainesville, Florida 32611
L.A. Silva, H.H. Van Horn, E.A. Olaloku, C. J. Wilcox, and B. Harris, Jr.
Journal of Dairy Science, V. 59, No. 12, p. 2071-2076, Dec., 1976. 5 tab., 29 ref.

Keywords: Dairy cattle, Refeeding, Dried poultry wastes, Milk production, ash, Performance.

Twenty-four lactating Holstein cows were in a partially balanced incomplete block design to study effects of graded percents of dried poultry waste (0, 10, 20 and 30 percent of complete ration) on milk production and composition. The dried poultry waste was a high-ash product due to loss of over 50 percent of organic nutrients during drying. Feed intake was similar for 0 and 10 percent rations but increasingly lower for 20 and 30 percent. Milk yield was reduced slightly (2.9 percent) for 10 percent in relation to 0 percent but progressively lower (19.4 and 34.5 percent) for 20 and 30 percent. The trend was the same for the rest of variables (protein percent, solids-not-fat percent, total solids percent, and total yield of these same variables and fat yield) except for milk fat percent which did not show a specific trend. All milks had desirable flavors with no differences due to rations. In a second trial, 10 lactating dairy cows were used to obtain apparent digestibility coefficients. Crude protein digestibility for complete ration was lower for 10 percent than 0 percent, and ether extract was lower for 30 percent than 20 percent. For 0 and 10 percent versus 20 and 30 percent, energy and crude fiber dry matter, crude protein, ether extract, and nitrogen free extract coefficients were lower for 20 and 30 percent, energy and crude fiber dry matter, crude protein, ether extract, and nitrogen free extract coefficients were lower for 20 and 30 percent. Up to 10 percent versus 20 and 30 percent, energy and crude fiber dry matter, crude protein, ether extract, and nitrogen free extract coefficients were lower for 20 and 30 percent. Up to 10 percent of complete rations for lactating dairy cows can be composed of dried poultry waste (even if high in ash) with little or no reduction in feed intake or milk production. Higher percents should be fed only if reduced feed intake and performance can be tolerated. (1976 copyright-Journal of Dairy Science)

4099-A8, B5, C2, E2, F1, F2

DESIGN PARAMETERS FOR THE LAND APPLICATION OF DAIRY MANURE

Department of Agronomy, Cornell University, Ithaca, New York 14853
S. D. Klausner, P. J. Zwerman and D. R. Coote
Environmental Protection Agency Report EPA-600/2-76-187, Oct., 1976, 248 p. 77 fig., 55 tab., 225 ref.

Keywords: Dairy manure, Land application, Design, Agricultural runoff, Snowmelt, Application rates, Nitrogen, Sediment, Tile effluent, Phosphorus, Crop response, Computer models, Economics, Surface drainage, Subsurface drainage, Legislation, Guidelines.

The effects of climate, application rate of dairy manure, timing of application and soil management practice were studied in relation to discharge of nitrogen and phosphorus via surface runoff, sediment and tile effluent. Losses of nutrients from the land were influenced by the rate and timing of manure application in addition to the type of climatological event causing runoff. The greatest discharge of nutrients resulted from applying manure on actively melting snow. Modest rates of application made in the winter during non-snowmelt periods resulted in minimal losses. Concentrations of nitrogen in surface runoff as measured over time, were lower than those found in tile effluent. The reverse was true for soluble phosphorus. The yield response of corn increased while efficiencies of nitrogen utilization decreased at the higher rates of application. A computer model dealing with the economic impact of control legislation was developed. Modeling approaches to farm scale environmental problems are feasible if assumptions and simplifications do not influence the results too greatly, or in ways which are unpredictable. (Klausner-Cornell)

4100-A8, B2, B5, C2, C3, E2

LIQUID WASTE MANAGEMENT AT A SLATTED FLOOR SWINE BARN

Department of Agricultural Engineering, University of Tennessee, Knoxville, Tennessee 37916
J. I. Sewell and J. R. Overton
Tennessee Farm Home Science Progress Report 87, July/Sept., 1973, p. 22-25. 4 fig., 5 tab., 4 ref.

Keywords: Swine wastes, Liquid wastes, Slatted floors, Waste collection pit, Nutrients, Bacteria, Land application, Crop response, Corn.

Liquid waste from a slatted-floor swine barn was applied beneath the soil surface of crop lands. During periods when swine-cooling sprinklers were not in use, the waste collected at 0.27 cubic feet per pig per day. Soon after the system was put into operation, the depth of settled solids on the pit floor averaged 8.5 inches; and 18 months later, the average depth had decreased to 1.8 inches. Few mechanical problems have been associated with waste removal or application to soil. Effects of waste applications on corn were not great. No stand or seedling injury was observed. Some grain yield depression occurred in 1971 under poor growing conditions. In 1972 under more favorable conditions, silage yields were slightly increased by waste applications on an alluvial soil and slighlty decreased on a terrace soil. (Sewell-University of Tennessee)

4101-A11, B3, C2, E3

NUTRITIONAL EVALUATION OF DRHYDRATED CATTLE MANURE USING SHEEP

Research Station, Agriculture Canada, Melfort, Saskatchewan SOE 1A0, Canada
S. O. Thorlacius
Canadian Journal of Animal Science, V. 56, No. 2, p. 227-232, June, 1976. 3 tab., 16 ref.

Keywords: Refeeding, Dehydrated cattle manure, Sheep, Nutrients, Digestibility, Performance.

Manure from a commercial feedlot was dehydrated at an alfalfa dehydration plant. The manure contained, on a dry matter (DM) basis, 14.8 percent crude protein, 14 percent ash, 0.83 percent calcium, 0.69 percent phosphorus, 30.5 percent crude fiber, and 2.6 percent fat. About 45 percent of the DM in the manure was wheat straw bedding. Each of three pelleted rations: 50 percent hay 50 percent barley (HB); 50 percent manure 50 percent barley (MB); and 100 percent manure (M) was fed ad libitum to eight individually penned yearling wethers in a 38-day feeding trial. In addition to the manure pellets, lambs on ration M were fed 200 g/day barley during the first 28 days on test. A digestibility trial, five wethers per treatment, was conducted after the 38-day feeding trial. Mean daily DM intake during the feeding trial was 2,054, 1,714, 1,165 (pellets only) g and mean daily gain was 272, 148, and -57 g for rations HB, MB, and M, respectively. The corresponding values were 2,632, 2,277, and 2,050 g for DM intake during the final 10 days of the feeding trial, 62.7, 51.7, and 26.7 percent for CM digestibility, and 70.9, 62.6, and 42.4 for nitrogen digestibility. Molar percent volatile fatty acids in rumen fluid of lambs on ration M were similar to those normally observed for high roughage rations. Molar percent acetic in rumen fluid of lambs on ration HB was greater ($P<0.05$) and percent valeric lower ($P\leq0.05$) than on ration MB. It was concluded that sheep will consume rations containing large amounts of dehydrated manure, but low digestibility of manure severely limits its value as a ration ingredient. (1976 Copyright-Canadian Journal of Animal Science)

4102-A7, B1

DIURNAL AND ANNUAL FLUCTUATIONS OF AERIAL BACTERIAL AND DUST LEVELS IN ENCLOSED SWINE HOUSES

University of Illinois, Urbana-Champaign, Urbana, Illinois 61801
S. E. Curtis, J. G. Drummond, K. W. Kelley, D. J. Grunloh, V. J. Mearse, H. W. Norton, and A. H. Jensen
Journal of Animal Science, V. 41, No. 5, p. 1502-1511, Nov., 1975. 4 fig., 10 tab., 28 ref.

Keywords: Swine houses, Air pollution, Bacteria, Dust, Sampling, Logarithms, Temperature.

Concentration of bacterial-colony-forming particles (BCFP) in the air of enclosed swine houses was observed continuously over a 24-hr period with an Andersen continuous monitor. Sampling was done for four 24-hr periods in a swine nursery and a swine growing house. In each period, aerial BCFP/m^3 of air were measured for each half-hourly interval. Aerial BCFP concentration within each 24-hr period was roughly a sinusoidal function of time, but runs within a house were asynchronous. No one time during a 24-hr period could be recognized as preferable for monitoring in studies of long-term changes in aerial BCFP concentration. Aerial levels of BCFP and dust were determined 44 or 48 times over 15 months in each of four enclosed and one modified-open-front University swine gestation and farrowing houses typical of those now used in north-central United States. An Andersen viable sampler and tryptose agar were used to measure BCFP, and a Staplex high-volume air sampler to measure dust. Common logarithms of aerial BCFP levels (no./m) for the five houses (mean SE) were: 5.16 .06, 4.88 .05, 5.02 .06, 4.99 .08, and 4.33 .06. These levels were comparable to those observed in 12 swine houses at five commercial swine operations. Common logarithms of dust levels (ug/m^3 were: 3.08 .05, 3.03 .06, 3.35 .05, 3.03 .06 and 2.89 .08, respectively. These levels were generally lower than those observed in 11 houses at five commercial operations. Both aerial BDFP level and aerial dust level were significantly and negatively correlated with median outside temperature. Regression analyses indicated that common logarithm of aerial BDFP level increased around .02 per Celsius-degree decrease in median outside temperature for the day and that common logarithm of aerial dust level increased around .01 per degree decrease. (1975 Copyright - Journal of Animal Science)

4103-A6, B1, C1, D1

PULLETS IN GROW CAGES ABOVE, HOGS IN PIT BELOW

Anonymous
Poultry Digest, V. 36, No. 420, p. 80, Feb., 1977.

Keywords: High-rise cage house, Poultry manure, Manure holding pit, Swine, Drug residues, Coccidiostats, Odor, Moisture content.

To better utilize space at his 55,000-bird high-rise cage house, Jim Garber of Lancaster County, Pennsylvania decided to run hogs in the manure holding pit to help pay off the heavy capitalization of the environmental-controlled building. The hogs mixed the droppings, feathers, etc. while rooting and walking through them, reducing moisture content of the wastes. Garber has run as many as 100 hogs at a time in the manure pit. They are fed a regular commercial mix to which home grown grains are added. He prefers to start feeder pigs that average 60-80 pounds. In about 20 weeks, the same time required to grow a pullet from day-old until it is housed as a layer, the hogs are moved out at weights ranging from about 220-240 pounds. With every batch of pullets, the manure is cleaned out of the pit area. The only concern with such a system is that hogs may pick up medication or drug residues from the pullet droppings. The main problem would be traces of coccidiostats fed to pullets and passed on to the hogs. Since Garber's birds are raised in cages, he doesn't feed coccidiostats. This type of system would not work very well with older laying hens in high-rise cage house because manure depths could get excessive. (Merryman-East Central)

4104-A3, A4, B1, C3

WATER QUALITY IMPLICATIONS OF CATTLE GRAZING ON A SEMIARID WATERSHED IN SOUTHEASTERN UTAH

Rangeland Resources Program, Oregon State University, Corvallis, Oregon
J. C. Buckhouse and G. F. Gifford
Journal of Range Management, V. 29, No. 2, p. 109-113, March, 1976. 1 fig., 1 tab., 26 ref.

Keywords: Watersheds, Grazing, Cattle, Coliforms, Public health, Agricultural runoff, Water pollution.

During 1973 and 1974 wildland water quality analyses were performed on a semiarid, chained and seeded, pinyon-juniper site in southeastern Utah. The area was treated in 1967 and protected from grazing until 1974. In 1974 livestock grazing was introduced and investigations continued to determine if any deleterious land use effects were present from fecal contamination by cattle. No significant changes were noted in fecal and total coliform production (fecal pollution bacterial indicators) from grazing use. There is an element of risk involved whenever data generated from a small area are projected to larger land areas. However, it appears that this level of livestock grazing (2ha/A UM) did not constitute a public health hazard in terms of fecal pollution indicators on the semiarid watershed. (Copyright 1976 - Journal of Range Management)

4105-A3, A4, A5, A8, A12, B2, C3, D1, D3, E2

FATE OF ANIMAL VIRUSES IN EFFLUENT FROM LIQUID FARM WASTES

Department of Veterinary Microbiology and Immunology, University of Guelph, Guelph, Ontario, Canada N1G 2W1.
J. B. Derbyshire
Journal of Milk & Food Technology, V. 39, No. 3, p. 214-217, March, 1976. 5 tab., 8 ref.

Keywords: Effluent, Swine wastes, Dairy wastes, Viruses, Soil contamination, Groundwater pollution, Agricultural runoff, Water pollution, Public health, Aeration.

Various aspects of viral pollution of the environment associated with disposal of liquid farm manure on agricultural land are being investigated. Techniques have been developed for concentration and recovery of animal viruses from various field samples. Seventeen of 22 samples of liquid manure from a swine fattening house yielded enteroviruses, adenoviruses, and a coronavirus. One enterovirus was isolated from six samples of waste from a swine farrowing house, but no virus was isolated from 18 samples of liquid cattle manure obtained from a dairy farm. A swine enterovirus was isolated from surface soil samples collected up to 8 days after liquid manure was spread on agricultural land. A swine enterovirus was also isolated from 2 of 26 samples of surface runoff collected from sites at which liquid pit manure was routinely spread on agricultural land. Thirty-three samples of surface water and 36 samples of ground water were collected in areas in which liquid pig manure was routinely spread on farm land, and a swine enterovirus was isolated from one surface water sample. Field and laboratory experiments indicated that enteroviruses are more rapidly inactivated in aerated liquid manure than in untreated manure. (Copyright 1976 - Journal of Milk & Food Technology)

4106-A6, A10, B2, B3, D3, E2, E3, F1

HANDLING AND DISPOSING OF POULTRY MANURE

Agricultural Extension Service, North Carolina State University, Raleigh, North Carolina
T. B. Morris
Poultry Pointers, May, 1974, 2 p.

Keywords: Poultry manure, Waste management, Solid wastes, Liquid wastes, Odor, Flies, Periodic clean out, High rise poultry buildings, Deep pits, Lagoons, Drying, Methane digesters, Economics.

Waste handling options for poultry manure include the following: (1) Daily, weekly, biweekly, and monthly clean out. If the manure is to be spread on pasture or crop land, it should be spread thinly so it will dry quickly. (2) Clean out once or twice a year. If possible, such clean outs should be done before and after flies are a real problem. By cleaning only once or twice a year, natural enemies are usually retained which help keep flies under control. This is especially true if a 4-6-inch pad of dry manure is retained at clean out time. (3) High rise or deep pits. In this system, manure may be retained for several years if it is kept dry. Clean out may be performed even if the birds are in the house. If manure in the pits can be kept dry and turned to compost, fly breeding is usually not a problem. (4) Lagoons. This system requires little labor (turning valves on and off about twice a week) to remove manure from under the cages. Flies and odor are not problems. (5) Drying poultry manure. Most drying units are rather expensive and operating cost adds to the total cost of drying poultry manure. *Pre-drying* with fans to below 60 percent moisture under cages reduces drying costs. Now that fertilizer has increased in price, the value of dried poultry manure will be higher. (6) Making methane gas from poultry manure. With the fuel shortage there seems to be a lot of interest in making methane gas from manure. The cost to build a methane generator has been estimated to vary from $5,000 to $50,000 for 20,000 hens. (Merryman-East Central)

4107-A8, B3, B5, C1, C2, E2

MANURING OF PERMANENT MEADOWS 1962-70

W. A. Kneale and J. Johnson
Experimental Husbandry, No. 22, London, Her Majesty's Stationary Office, 1972, p. 15-21. 9 tab., 3 ref.

Keywords: Land application, Application rates, Farmyard manure, Crop response, Permanent meadows, Swards, Fertility, Dry matter production, Nitrogen, Phosphate, Potash.

A long term experiment (1953-1970) to measure the effects of annual dressings of farmyard manure and the interactions of farmyard manure with applied nitrogen, phosphate, and potash was conducted at Great House Experimental Husbandry Farm. The site was on a permanent meadow at an altitude of 1050 ft. This paper reports on the second 8-year period of the 16-year experiment. Results revealed that: (1) On an upland meadow, cut annually for hay, dry matter production rose over a period of 18 years where farmyard manure was applied but in the absence of farmyard manure, dry matter production fell. (2) Application of artificial nitrogen at 31 units per annum or 62 units per annum did not maintain fertility at as high a level as 15 tons per acre per annum farmyard manure (FYM). (3) There was no response to additional phosphate in the pesence or absence of FYM. (4) There was no response to additional phosphate in the presence or in its absence a small response was shown. (5) Under the hay cutting regime adopted and with the exclusion of stock from the experimental area, sward changes occurred with *Alopecurus spp* and *Agrostis spp* being favored at the expense of *Lolium spp* and *Poa spp*. (Bates-East Central)

4108-A11, B3, C2, C3, E3

POULTRY WASTES AS FEEDSTUFFS FOR RUMINANTS

Department of Animal Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
J. P. Fontenot and K. E. Webb, Jr.
Federation Proceedings, V. 33, No. 8, p. 1936-1937, 1974.

Keywords: Poultry wastes, Caged layer manure, Poultry litter, Chemical properties, Biological properties, Ruminants, Performance, Disease organisms, Drug residues, Copper toxicity, Sheep, Cattle, Food & Drug Administration.

Poultry enterprises produce 2 types of wastes – caged layer manure and poultry litter. Poultry litter, the usual type of waste resulting from broiler production, may be from 1 or more crops of birds. A number of experiments have been performed in which poultry wastes were refed to animals. Crude protein content of poultry wastes has averaged 28 percent and higher. 45 percent of the nitrogen in broiler litter is protein. 41 percent of the nitrogen in caged manure is in the form of amino acids. Poultry wastes may be important sources of energy as well as nitrogen for ruminants. Poultry wastes are also good sources of calcium and phosphorus. Refeeding poultry wastes is not sanctioned by the Food and Drug Administration due to potential hazards from possible disease organisms and drug residues, even though no such problems have been reported from the experiments that have been done. Copper toxicity was observed in ewes fed poultry litter containing high levels of copper due to the feeding of high levels of copper sulfate to chicks, but this is the only detrimental health effect that has been reported. (Merryman-East Central)

4109-A6, B2, C1, C2, D1, D3

EVALUATING A LOW-ENERGY, HIGH-VALUE PUMP FOR ODOR REDUCTION FROM LIVESTOCK WASTE LAGOONS BY MIXING

Agricultural Engineering Department, Oklahoma State University, Stillwater, Oklahoma
C. E. Rice
Completion Report, Department of Agricultural Engineering, Oklahoma State University, 1976, 19 p. 7 fig., 1 tab., 2 ref.

Keywords: Pumps, Odor control, Lagoons, Swine wastes, Mixing, Aerobic conditions, Anaerobic conditions, Gases, Physical properties, Chemical properties.

A low-energy, high-value propellor pump was placed in a lagoon receiving manure material from a confined housing with pit collection swine production operation to evaluate its effectiveness in the reduction of offensive odor from the lagoon. The retention time in the pits was 26 days or greater. Another lagoon of the same size (0.405 hectare surface area by 2.2 m deep), subject to similar conditions, was close by and provided a comparison of a treated (lagoon with pump) system with an untreated (lagoon without pump) system. The lagoons were anaerobic, very turbid, and had no dissolved oxygen. The pump could completely mix the lagoon liquid about every 4 hours and it was operated from July 17, 1975, through January 6, 1976. COD, BOD_5, DO, pH, temperature, conductivity and general observations were obtained on a weekly basis beginning 2 weeks before start-up of the pump and through May, 1976. The observed results for the treated and untreated systems followed the same pattern. This indicated that the pump was not having a significant effect on the lagoon. The major difference observed was that the boiling activity, caused by the release of accumulated gases from the lagoon to the atmosphere, of the treated lagoon was reduced significantly compared to the untreated lagoon. (Rice-OSU)

4110-B1, D3, E3

NATURAL GAS FROM THE BARNYARD, OR "JUST MOVE BOSSY OVER AND HOOK IT UP"!

Anonymous
Conservation News, V. 39, No. 2, p. 2-4, Jan. 15, 1974. 2 fig.

Keywords: Recycling, Fuels, Methane generator, Fertilizers, Costs, Economics.

Richard Shuttleworth of Redkey, Indiana has constructed and is operating a methane generator which simply and automatically transforms ordinary cow manure into "homemade fuel oil" and "homemade gasoline" with which he can run an automobile engine, power a gas stove, fuel lamps, operate a gas refrigerator, and fire a space heater. This methane generator turns organic waste of any kind into *nitrogen-rich fertilizer and methane* gas. Installation cost was approximately $10,000, but Fry has harvested more than $16,000 worth of methane gas from waste produced by his livestock in just the first 6 years. In addition, he estimates that he saved about $20,000 in manure handling costs and reaped an additional windfall of nitrogen-rich fertilizer worth at least another $20,000. (Merryman-East Central)

4111-B1, E2

OPERATIONAL & MAINTENANCE TIPS TO GET MOST FROM MANURE SPREADER

Anonymous
Wyoming Stockman Farmer, V. 82, No. 3, p. 76, March, 1977

Keywords: Manure, Land spreading, Equipment, Maintenance, Box spreaders, Tank spreaders.

The value of manure as a commercial fertilizer substitute has increased dramatically in the past few years. To take full advantage of this, farmers must be able to perform their spreading quickly and efficiently. Sperry New Holland engineers offer tips on operation and maintenance of box and tank spreaders to achieve this purpose. The apron chain on box spreaders should receive proper adjustment and regular oiling. The belt drive should be checked periodically to be sure that it is not over-tightened. Sliding parts of the PTO should be lubricated to guard against universal joint failure. Hookup to the PTO should always be inspected to be sure it is correctly done. Drive chains should receive a regular maintenance check. Modifications of safety features should be avoided. The spreader should only be cleaned when the PTO is disconnected. Lubrication of the PTO sliding section on tank spreaders is necessary to prevent damage to the PTO assembly and the rear stub shaft to which it is attached. The flair chains on tank spreaders should be continually checked. As they wear, the flair chains should be shortened to avoid damage to the edge of the tank. They should only be shortened twice before replacement. Chains should be replaced in pairs in order to maintain rotor balance. Manure buildup on the lid and cover should be periodically removed to insure proper hydraulic opening. In hauling liquid manure, the spreader should be loaded to just below the rotor. In hauling pen-type manure, the rotor ends should not be covered so that the starter arms are exposed to permit unloading. Horse power should be gauged to the type of manure. The manure bucket or large chunks of frozen manure should never be dropped on the rotor. The spreader should be started before the loader in freezing weather. (Keel-East Central)

4112-A8, B3, B5, C2, E2

EFFECTS OF ANIMAL MANURE ON SOYBEANS AND SOIL

F. L. Long and E. M. Evans
Highlights of Agricultural Research, V. 24, No. 1, p. 12, Spring, 1977. 2 tab.

Keywords: Land application, Dairy manure, Crop response, Soybeans, Iron deficiency, Salinity, Carbon, Nodulation.

The effects of dairy cattle manure on soil properties and on soybean yield and composition were measured. Dairy manure was spread at 107 tons per acre and rototilled into the top 8 inches of the soil. Check plots received 0-14-14 fertilizer at the rate of 1000 lbs per acre. Test plots were planted in Hutton soybeans about 4 weeks after the last manure application. Study results revealed that soybean yield can be increased by high rates of manure. but soil pH goes high enough to cause temporary iron deficiency. High salt concentrations occur down to at least 24 inches and little nodulation occurs. Carbon is also increased in the soil to the 24-inch depth. (Bates-East Central)

4113-B2, B4, C2, E2, F1

MANURE STORAGE AREAS HELP SAVE NUTRIENTS

C. D. Stoddard
Hoard's Dairyman. V. 122, No. 6, p. 374, March 25, 1977. 2 fig.

Keywords: Waste storage, Piston pumps, Nutrients, Economics, Safety measures.

Manure storage areas loaded from the bottom by piston pumps preserve more nutrients for crops, compared to manure stored on open lots, or lagoon effluent spread through sprinkler irrigation. Researchers value manure pack nutrients from a 1000-pound cow at $35.52 per year, if promptly plowed under. Weather-exposed open lot manure is worth only $19.88 and manure effluent pumped from a lagoon through a sprinkler irrigation system drops to $13.44. Owners of piston manure pumps report that a matted crust on manure has an insulating effect which helps bacteria decompose organic matter at a controlled rate, reducing odor and nitrogen loss. Manure basins should be fenced, docks should be equipped with guard rails, and pump hoppers should be covered for safety. (Bates-East Central)

4114-A1, A11, B1, B2, B4

FEEDLOT POLLUTION CONTROL IS NOT AN EXPENSIVE ITEM: LINDER

Anonymous
Beef, V. 8, p. 25, April, 1972. 3 fig.

Keywords: Pollution control, Feedlots, Confinement pens, Agricultural runoff, Holding ponds, Waste storage, Waste management, Aesthetics, Feed conversion.

Some methods for controlling pollution from feedlots were presented at a convention of the National Livestock Feeders Association. One system includes a diversion to hold runoff out of the draws between the mounds in the pens and a debris basin which drains through a pipe into a holding pond. The Soil Conservation Service designed and helped pay for this system which is used by a Loomis, Nebraska feeder. The advantages of confinement feeding with oxidation ditches were presented by an independent hog man and a representative of the Iowa Beef Packers. The main benefits were improved aesthetics and better feed conversion. An agricultural engineer also emphasized that any manure storage system will work only if it is managed properly. (Bates-East Central)

4115-B3, D3, E3, F1

DIGESTER GAS FOR AUTOMOBILES

Consulting Sanitary Engineer, Schondorf, Bavaria, Germany
K. Imhoff
Sewage Works Journal, V. 18, No. 1, p. 17-25, Jan., 1946. 5 fig., 1 tab., 12 ref.

Keywords: Methane, Organic wastes, Sewage, Stable manures, Digestion, Recycling, Fuels, Rural gasworks, Gasoline substitute, Fertilizers, Economics.

In Germany, methane is produced by digesting and gasifying organic matter in municipal sewage treatment plants. Methane has proved to be a good substitute for gasoline as an automobile fuel. The gas is ordinarily carried in steel cylinders at 200 atmospheres (3,000 psi) pressure, but it may be stored in bags which are not under pressure. The quantity of digester gas produced at municipal sewage treatment plants is small in comparison with the demand for gasoline. The quantity of gas can be increased enormously if solid organic wastes such as stable manure are digested. The quantity of gas available from the stable manure of one cow is more than 100 times the per capita gas production of municipal sewage treatment plants. Residues from the stable manure digestion may be used as fertilizer. Rural digester gasworks could become an alternative source of automobile fuel for Germany and some other countries. (Bates-East Central)

4116-B2, D3, F1

FLUSHING GUTTERS FOR HOG BUILDINGS

Anonymous
Kansas Farmer, V. 113, No. 20, p. 12-14, 33, Nov. 20, 1976. 5 fig., 1 tab.

Keywords: Waste management, Swine, Flushing, Lagoons, Design, Open gutter flushing, Underslat flushing.

Flushing is a relatively new concept for removing wastes from a hog building to a lagoon. There are two types of systems used. The open gutter flushing system has been used successfully in finishing buildings and open concrete lots. Underslat flushing has been successful in farrowing, nursery and gestation buildings. The four basic parts of a flushing system are floor and gutter, flush tank, waste treatment lagoon, and circulation pump and pipes. Design and operation recommendations are given. Advantages of using a flush system are: (1) Lower initial building costs, (2) Odor control, (3) Waste disposal may be less frequent, (4) Adaptability to waste irrigation, (5) Adaptability to building conversion, (6) Construction flexibility. Disadvantages are: (1) Greater nutrient loss, (2) Requires careful management, (3) Requires a relatively large land area, (4) Interruptions to give medication, (5) Not practical for farrowing and nursery buildings, (6) Subject to mechanical problems, (7) Possibility of disease transmission. It is wise to consult an Extension agent and/or a professional engineer and/or a farm building contractor before changing present facilities or constructing new ones. (Keel-East Central)

4117-A6, A10, B3, C1, D1, E2

HANDLING MANURE IN THE DEEP-PIT OR HIGH RISE CAGE LAYING HOUSE

Poultry Specialist, Ministry of Agriculture, Abbotsford, British Columbia
D. M. Hamilton
Feedstuffs, V. 49, No. 4, p. 78, 83, Jan. 24, 1977. 6 fig.

Keywords: Deep-pit cage houses, Poultry wastes, Drying fans, Odor control, Fly control, Moisture content, Waste management, British Columbia, Land spreading.

Manure drying fans, suspended directly below the cake in deep-pit cage layer houses with full stairstep cages or tri-deck cages produced manure with an average moisture content of 25 percent, as compared to 76 percent in fresh manure. The manure was easy to handle and the odor problem was reduced both in moving and spreading. Before installing drying fans the following precautions must be taken: (1) A concrete floor is essential. (2) No outside water can be allowed to enter the pit area. (Deep-pit houses should be constructed on top of the ground.) (3) Watering systems should be carefully maintained to prevent spillage. (4) The house must be mechanically ventilated and properly insulated. The temperature is controlled by adjustment of air inlets and thermostatically controlled exhaust fans. (5) Check to see that electrical circuits will carry the extra load of the drying fans. Fly population in these houses has been reduced so that spraying only once around the doors and light globes is all that is required. Cleaning out and restocking during winter months when no flies are about starts the house out free of flies. (Bates-East Central)

4118-A8, B2, B3, B5, C2, E2

NITRATE CONTENTS OF SUDANGRASS AND BARLEY FORAGES GROWN ON PLOTS TREATED WITH ANIMAL MANURES

Department of Soil Science, University of California, Riverside, California
P. F. Pratt, S. Davis, R. G. Sharpless, W. J. Pugh, and S. E. Bishop
Agronomy Journal, V. 68, No. 2, p. 311-314, March-April, 1976. 5 fig., 2 tab., 11 ref.

Keywords: Land application, Liquid wastes, Solid wastes, Manure treatments, Irrigation, Application rates, Crop response, Barley, Sudangrass.

Experimental objectives were: (1) to determine the effects of rates of two types of manure and two irrigation rates on the $NO\text{-}_3$ contents of sudangrass and barley forages and (2) to determine the limitations that excess $NO\text{-}_3$ in forages might impose on the rate of manure application in the culture of these two crops. A field trial on the Moreno Farm of the University of California, Riverside was conducted to respond to these objectives. Dry coarse dairy manure and liquid manure from a feedyard and two irrigation treatments (ET and 1.33 ET) were applied on a Hanford sandy loam. During the third year of application, barley and sudangrass were planted and analyzed for $NO\text{-}_3$. Nitrate concentrations in barley decreased progressively as the crop matured and were higher with liquid manure applications than with dry manure applications. Nitrate concentrations were not affected by irrigation levels. $NO\text{-}_3$ concentrations were found to increase in sudangrass until the flower heads sprouted and then $NO\text{-}_3$ concentrations decreased. Liquid applications of manure caused higher $NO\text{-}_3$ concentrations than dry manure applications. The lower the water level, the higher the concentration. Experimental results indicated that a safe application limit for dry manure is 29 air-dry metric tons/ha/year, 13 English tons/acre/year, 520 kg N/ha/year, or 465 pounds N/acre/year. The safe limit for the liquid manure was found to be about 8.6 metric tons of dry material/ha/year, 3.8 English tons/acre/year, 410 kg N/ha/year, or 370 pounds

N/acre/year. Of course, these limits applied to the management practices utilized in these experiments. (Bates-East Central)

4119-B1, C2, D2, D3, E3, E4, F1
HARNESSING ENERGY SOURCES FOR THE FEEDLOT

Anonymous
Calf News, V. 15, No. 4, p. 12, 46, April, 1977. 2 fig.

Keywords: Energy, Feedlots, Recycling, Methane, Solar energy, Wastewater treatment, Algae, Economics, Research.

Several new research projects are underway concerning the application of alternative energy sources for feedlots, according to an interview with Dr. Bart P. Cardon, chairman of the board of Arizona Feeds. He says that Texas Tech University is working on a feed mill for their feedlot powered by solar energy. Both the Energy Resources Development Authority (ERDA) and the American Feed Manufacturing Association are encouraging development of this plan. Bio-Gas of Colorado and the Four Corners Energy are investigating the use of animal wastes as an energy source. Bio-Gas wants to sign up a series of feedlots and then build a central plant to which manure may be hauled and fermented into methane. The waste material from this process would be sold as fertilizer. The estimated selling cost for methane gas would be about $2.50/million BTU's. The wastewater generated could be purified by a special species of algae that could be fed back to the cattle. The University of Arizona has plans to develop an animal research center for energy. The University of Arizona has called upon Arizona Feeds to work with them in the development of energy research projects. Dr. Cardon has suggested the following areas of research: (1) a project for methane production from animal and plant wastes, (2) recycling of animal wastes, (3) processing and possible chemical treatment of plant refuse for recycling, and (4) focusing of the energy needs to process grain. (Bates-East Central)

4120-A8, B3, B5, C1, C2, E2
POULTRY MANURE FOR FIELD CROP PRODUCTION

Extension Agronomist. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida 32601
D. W. Jones, L. W. Kalch, D. A. Graetz, and C. R. Douglas
Agronomy Facts, No. 51, Florida Cooperative Extension Service, University of Florida, June 16, 1975, 4 p. 2 tab.

Keywords: Poultry manure, Land application, Nutrients, Application rates, Crops.

Some guidelines are given for poultry manure applications to crops in Florida. There are two types of poultry manure: (1) cage layer manure-pure manure that collects or cones up under laying cages. (Each layer produces about 60-80 lbs of dry air manure/year which has a composition of 2.11 percent N, 0.33 percent P O , and 2.18 percent K_2O). (2) Broiler manure - a mixture of manure and litter material from hens that are grown on the floor. (Each broiler generates 8 lbs of manure/year which has 2.74 percent N, 2.50 percent P_2O_3 , and 2.32 percent K_2O. Composition of chicken manure will vary considerably depending on feed and composition, moisture content, age of manure, presence and type of litter, and conditions of storage. Composition of manure and requirements of the crop to be grown must both be taken into consideration when poultry manure is to be used as a source of plant nutrients. Suggested rates and time of application are given for the following crops: (1) Corn, Sorghum, (2) Pearlmillet, Sorghum, & Sudangrass, (3) Small grains, (4) Perennial grass pasture, (5) Grass - Legume pastures, (6) Soybeans, (7) Peanuts, and (8) Tobacco. (Bates-East Central)

4121-A8, A11, B2, B5, C2, E2
THE EFFECT OF DISPOSING HIGH RATES OF COPPER-RICH PIG SLURRY ON GRASSLAND ON THE HEALTH OF GRAZING SHEEP

Greenmount Agricultural and Horticultural College, Antrim, Northern Ireland
H. I. Gracey, T. A Stewart, J. D. Woodside, and R. H. Thompson
Journal of Agricultural Science, V. 87, Pt. 3, p. 617-623, Dec., 1976. 3 fig., 5 tab., 34 ref.

Keywords: Swine wastes, Slurries, Animal health, Sheep, Copper poisoning, Copper sulphate, Application rates.

Over a 3-year period 900 m^3/ha of copper-rich pig slurry were spread during the growing season on a 0·6 ha permanent grassland sward and the grass continually grazed off each season with the same sheep. A total of 47 kg Cu/ha were applied to the area and this increased the EDTA-extractable copper in the topsoil. Herbage copper concentrations clearly showed that sheep grazing the area were continually exposed to high concentrations, and that most of the copper was present as surface contamination. Large quantities of copper were excreted in the sheep faeces indicating that copper passed through the animal. Monthly blood samples from the sheep showed that the enzyme glutamic-oxaloacetic transaminase (GOT) concentrations were slightly higher than those in sheep grazing an area which received no copper over the same period. By the end of the second season (October 1971) over 2000 i.u. GOT/1 were recorded in some sheep grazing the slurry treated area indicating severe liver breakdown at that time. However, during the winter when the sheep were inwintered, serum GOT concentrations decreased considerably. In the final grazing season a 0·2 ha area received monthly applications of copper sulphate instead of slurry. All sheep were slaughtered in November 1972 for post-mortem examination. There was little difference in the copper concentrations in the liver and kidneys of the sheep grazing the control and the slurry areas, although the sheep which grazed the copper sulphate area in the final season had higher concentrations. As no sheep died from chronic copper poisoning during the course of the investigation there would appear to be little or no danger to the health of sheep from grazing land which is receiving pig slurry at rates which supply less than 16 kg Cu/ha/year. (Copyright 1976-Journal of Agricultural Science)

4122-A11, B1, C3
INHIBITORY EFFECT OF USED LITTER ON SALMONELLA TYPHIMURIUM TRANSMISSION IN THE CHICKEN

Department of Veterinary and Animal Sciences, University of Massachusetts, Amherst, Massachusetts 01002
O. M. Olesiuk, G. H. Snoeyenbos, and C. F. Smyser
Avian Diseases, V. 15, p. 118-124, 1971. 4 tab., 9 ref.

Keywords: Litters, Poultry *Salmonella typhimurium*, Animal health, Disease.

Four sequential trials were conducted to determine the effect of used litter on the transmission pattern of *S. typhimurium* in chickens. The pens were unoccupied for only three to five days between trials and the litter in the pens was not changed during the 32-week study. The pens were initially populated with four-week-old chicks infected with *S. typhimurium*. Pens were repopulated at approximately bimonthly intervals with 25 *uninoculated one-day-old chicks infected with S. typhimurium* or with one or two inoculated principals and 23 or 24 contacts, totaling 326 birds. Infection was determined by culturing litter and cloacal swabs from all birds at weekly intervals. None of the uninoculated chicks reared in pens on used litter following removal of infected groups of chicks yielded *S. typhimurium* even though sporadic isolations were made from the litter. When infected principals and contacts were introduced into the test-pens, the used litter yielded a lower rate of salmonella recovery in the contacts than in the controls started on new litter, and sharply moderated the rate of transmission and duration of infection. (Copyright 1971 - Avian Diseases)

4123-B3, C2, D1, D3, E2, F1
COMPOSTING MAKES MANURE HANDLING EASY

Anonymous
Colorado Rancher & Farmer, V. 31, No. 4, p. 30, 32, April, 1977. 4 fig.

Keywords: Composting, Feedlots, Windrows, Fermentation, Aeration, Grinding, Bacteria, Economics, Pollution control.

Lester Kuhlman of Sterling, Colorado sees cattle manure as a source of valuable compost capable of improving soil fertility and increasing crop yields. Kuhlman, president of Colorado-Nebraska Compost Corporation, is using a new technique to compost manure at the feedlot site. The composting technique involves these steps: (1) Manure is removed from the pens with conventional equipment and placed in 5-foot high by 10-foot wide windrows. Runoff from the windrows is channeled to a lagoon. (2) A special bacterial culture is added to the windrows as a machine passes over the windrows, grinding and aerating the manure. (3) Bacteria multiply and the windrow material heats to about 140° F., killing all disease organisms and weed seeds. Within 48 hours after the manure is windrowed, the odor and fly problem disappears. (4) Windrows are machine-aerated every 3-6 days. Within 6-8 weeks, the fermentation process is complete. Kuhlman says this mechanized method of composting is by far the cheapest means that has been developed. Most of the feedlots operate on a 50-50 basis with the composting corporation. In addition to farm application, a bagged compost trade is beginning. Nebraska feedlot operators state that composting provides the following benefits: (1) Manure volume is cut in half. (2) Because the compost is concentrated, application rates are much less than with raw manure and spreading time may be reduced as much as 75 percent. The compost can be stockpiled for over a year, so there's no waiting until fields dry out for spreading before pens can be cleaned. While the compost is not intended to replace all commercial fertilizer, it can replace a good share of it. Unlike manure, compost nitrogen is immediately available to plants at the time of application. Worth of the compost varies with the quality of the manure used. Manure low in sand or dirt from feedlot pens is worth considerably more than sand laden manure. (Merryman-East Central)

4124-A9, B1, C3, D2
EFFECT OF DIETARY OXYTETRACYCLINE ON MICROORGANISMS IN TURKEY FECES

Department of Bacteriology, North Dakota State University, Fargo, North Dakota 58102
B. B. Baldwin, M. C. Bromel, D. W. Aird, R. L. Johnson, and J. L. Sell
Poultry Science, V. 55, No. 6, p. 2147-2154, Nov., 1976. 3 fig., 4 tab., 22 ref.

Keywords: Diets, Oxytetracycline, Microorganisms, Turkey feces, Antibiotic resistance

Thirty-six two-day old male turkey poults were divided into three groups and fed three levels of oxytetracycline; 0, 110 or 440 mg. per kg. of ration, respectively, for nine weeks. The poults were given an oral spectinomycin plus vitamin treatment at the hatchery but were not fed before the start of the experiment. Defecated feces from each group were sampled at weekly intervals and analyzed for bacteriological content, especially for members of the *Enterobacteriaceae*. Total aerobic counts of 3 x 10^8 and total anaerobic counts of 2 x 10^9 were obtained. The majority of the *Enterobacteriaceae* were *Escherichia coli* but some *Klebsiella* sp., the *Bethesda-Ballerup* group of paracolon bacteria and *Arizona* sp. were also isolated. Antibiograms of the enteric isolates indicated that an increase in multiple antibiotic resistance occurred when increased amounts of antibiotic were fed. (Copyright 1976 - Poultry Science)

4125-A7, B1, C2, D1
EFFECTS OF BEEF HOUSING SYSTEMS ON GASEOUS CONTAMINANTS REMOVED BY VENTILATION

Department of Agricultural Engineering, University of Alberta, Edmonton, Alberta, Canada
J. J. R. Feddes and J. B. McQuitty
Canadian Agricultural Engineering, V. 15, No. 2, p. 119-123, Dec., 1973. 3 fig., 2 tab., 11 ref.

Keywords: Housing systems, Cattle, Ventilation, Slatted floors, Straw bedding, Carbon dioxide, Ammonia, Aeration rotors.

This study investigated the effects of slatted-floored and straw-bedded beef housing systems on ammonia and carbon dioxide removal by ventilation. Two exhaust levels were included within each housing system to study the influence of outlet height on the removal rates of the two gases. The effects or operating aeration rotors in pits below the slatted floor on the gas removal rates also were investigated. The five treatments considered for both exhaust levels were three, two, one, and no rotors operating in the slatted-floor system and the straw-bedded system. Sampling procedures involved monitoring the ammonia and carbon dioxide concentrations of the air entering and leaving each housing system. The air also was sampled at animal level. Results show that the housing systems had no significant effects on the concentrations of the two gases removed for similar rates of ventilation. With no rotor operating and in the straw-bedded system, outlet location had little effect on gas removal rates. Exhausting air below slat level increased the rate of ammonia removal but not that of carbon dioxide. Carbon dioxide produced by the wastes in either system was negligible compared with that respired by the animals. (Copyright 1973 - Canadian Agricultural Engineering)

4126-B1, C1, D1
EFFECTS OF BEEF HOUSING SYSTEMS ON MOISTURE REMOVED BY VENTILATION

Department of Agricultural Engineering, University of Alberta, Edmonton, Alberta, Canada
J. J. R. Feddes and J. B. McQuitty
Canadian Agricultural Engineering, V. 15, No. 2 p. 113-118, Dec., 1973. 7 fig., 1 tab., 8 ref.

Keywords: Housing systems, Cattle, Slotted floors, Straw bedding, Ventilation, Moisture content.

This study investigated the influence of slatted-floored and straw-bedded beef housing systems on moisture removed by ventilation. Two exhaust levels were included within each housing system to study the effects of outlet height on water vapor removal rates. The effects of operating aeration rotors in pits below the slatted floor on the moisture load to be removed by ventilation also was investigated. A moisture balance was established for each treatment. Sampling procedures involved monitoring wet and dry bulb temperatures of air entering and leaving each housing system. Moisture entering each system via feed and water provided for the cattle and accumulated moisture in the manure pack and pits were measured. Results showed significant differences between treatments with respect to water vapor removal rates. These rates for the straw-bedded and slatted-floor system with no rotor were in the ratio of 1.00: 0.69 under similar ventilation rates. Exhausting air below slat level increased the rate of moisture removal when rotors were in use. In the slatted-floor system with no rotor and in the straw-bedded system, outlet height had little effect on removal rates. (Copyright 1973 - Canadian Agricultural Engineering)

4127-A6, B1, F2
GOOD ANIMAL WASTE MANAGEMENT REDUCES ODORS AND COMPLAINTS

Agricultural Engineering Department, University of Illinois, Urbana, Illinois 61801
A. J. Muehling
Paper 74-II-110, VIII International Congress of Agricultural Engineering, Flevohof, The Netherlands, Sept. 23-29, 1974, 5 p.

Keywords: Odor control, Waste management, Nuisance suit.

Controlling undesirable odors from livestock wastes has become a major concern in the development of new and larger livestock units. The threat of a civil suit by irate neighbors is an important consideration for livestock feeding operators. Methods which have been developed to minimize odors include: (1) Locate livestock unit wisely. Select a site that is remote from residences and commercial development. (2) Provide good housekeeping. Regular cleaning of entire operation will minimize odors and let neighbors know that you are concerned with preserving a desirable environment. (3) Use good judgment when hauling wastes. Schedule cleaning and hauling when climatic and soil conditions favor dispersion and dilution of odors released. Do not haul in fields next to your neighbor's dwellings. (4) Provide proper environment. Adequate ventilation is a major item in reducing the odor level inside enclosed livestock shelters. (5) Consider aerobic treatment of wastes. Livestock wastes treated in the presence of free oxygen are free of objectionable odor. These systems include the oxidation ditch, the mechanically aerated lagoon, or the oxidation pond. (6) Investigate use of odor control chemicals. Either odor control or masking agents are available. (7) Properly dispose of dead animals. (8) Communicate with neighbors. Visiting with neighbors and discussing what you are doing to control odors may eliminate a costly civil nuisance suit. (Bates-East Central)

4128-B2, C1
FLOW PROPERTIES OF DAIRY WASTE SLURRIES

Department of Agricultural Engineering, University of British Columbia, Vancouver, British Columbia, Canada
L. M. Staley, M. A. Tung, and G. F. Kennedy
Canadian Agricultural Engineering, V. 15, No. 2, p. 124-127, Dec., 1973. 6 fig., 1 tab., 9 ref.

Keywords: Dairy wastes, Slurries, Shear rates, Flow rates, Solids, Design.

Dairy manure slurries of varying solids content were tested in a Haake Rotovisko rheometer over a wide range of shear rates. The resulting data accurately fitted a power-law model for which the flow parameters were determined. These parameters were used to calculate a generalized Reynold's number and Fanning friction factor. Darcy's equation then gave pressure drops for selected pipe sizes and flow rates. Field experiments were conducted by pumping dairy manure through 3- and 4-inch (7.6- and 10.2-centimeter) diameter irrigation pipe. Flow rates, solids content, and pressure drops were measured. After applying corrections for the effect of pipe couplers, measured and calculated pressure drops were compared and found to be in good agreement. The method of applying viscometric data to predict pipeline flow appears to have good potential in the design of distribution systems for dairy waste slurries. (Copyright 1973 - Canadian Agricultural Engineering)

4129-A3, A4, A5, B1, E2
NONPOINT SOURCES: STATE-OF-THE-ART OVERVIEW

Texas Agricultural Extension Service, Texas A&M University, College Station, Texas 77843
J. M. Sweeten and D. L. Reddell
Paper No. 76-2563, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 40 p. 4 fig., 4 tab., 62 ref.

Keywords: Water pollution, Runoff, Nonpoint sources, State-of-the-Art, Sediment, Nutrients, Pesticides, Livestock wastes, Land disposal, Agriculture, Silviculture.

A review of the state-of-the-art reveals that a considerable volume of research has been published in the last three decades on non-point source pollution as a result of agricultural and silvicultural activities. Topics that have been investigated include: characteristics of nonpoint sources, background levels of pollutants, sediment, estimating sediment loss, estimating nutrient and pesticide losses, pollutants resulting from livestock production, manure loading rates from grazing animals, distribution of excreta from grazing cattle, and land disposal sites as nonpoint sources. Nonpoint source loads within a watershed may be estimated by using 3 categories of data: (1) physical characteristics of the watershed, (2) hydrologic characteristics, and (3) land management practices. Two methods of estimating nutrient and organic matter loads are: (1) calculating sediment yields, and (2) multiplying sediment yields by factors denoting nutrient concentrations in the soil enrichment in the soil erosion process. Major pollution problems caused by manure are oxygen-demanding organic matter, plant nutrients and infectious agents. Guidelines for minimizing water pollution from land disposal of animal wastes include the following: (1) Schedule rate, time and frequency of application for maximum nutrient utilization by plants, (2) Apply wastes uniformly, (3) Select disposal areas with low erosion potential, (4) Avoid flood plains, grassed waterways or natural drainage paths, (5) Avoid highly permeable soils where high water tables exist, (6) Plow under or inject manure applied to barren fields, and (7) Avoid waste applications on frozen or snow-covered land. (Albertson-East Central)

4130-A2, A4, B2, B4, D1, E2

FEEDLOTS AND RECREATION LAKES: AN EXAMPLE OF HOW THEY CAN BE GOOD NEIGHBORS

Agricultural Research Service, U. S. Department of Agriculture and Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska
J. A. Nienaber, J. L. Gartung, and C. B. Gilbertson
Farm, Ranch, and Home Quarterly Reprint, Nebraska Agricultural Experiment Station, V. 22, No. 2, Summer, 1975, 2 p. 1 fig.

Keywords: Feedlots, Recreation lakes, University of Nebraska, Environmental Protection Agency, Agricultural runoff, Runoff control, Debris basins, Holding ponds, Land disposal, Irrigation, Rainfall.

A feedlot disposal system was designed by the Agricultural Engineering Department of the University of Nebraska-Lincoln (UN-L) to prevent contamination of a recreational lake. EPA awarded a contract to L. P. Schram Feedlot Inc. to carry out research in cooperation with UN-L. Three system components were used to manage precipitation runoff from the feedlot: (a) debris basin, which collected runoff and removed settleable solids from the liquid to be handled with conventional pumps, (b) holding pond, which collected liquid drained from debris basin and stored it for application to the land, (c) disposal system which distributed liquids on the land by irrigation techniques. The system proved to give sufficient runoff control in both average and above average rainfall periods. (Albertson-East Central)

4131-A11, B3, C3

THE ROLES OF AMMONIA, WATER ACTIVITY, AND pH IN THE *SALMONELLACIDAL* EFFECT OF LONG-USED POULTRY LITTER

Department of Veterinary and Animal Sciences, University of Massachusetts, Amherst, Massachusetts 01002
P.C.B. Turnbull, and G.H. Snoeyenbos
Avian Diseases, V. 17, p. 72-86, 1973. 6 fig., 2 tab., 20 ref.

Keywords: Litter, Salmonella, Survival rates, Ammonia, Moisture content, pH, Lyophilized salmonella.

Lyophilized salmonella cells exposed to atmospheres of 3 different water activities (a_w) showed negligible death rates at very low a_w both without ammonia and with ammonia at 100 to 400 µg/ml air. Apart from some variation among the 3 serotypes tested, death rates increased as a_w was raised from approximately 0.5 to values approaching 1.00. Ammonia added to these atmospheres accelerated the death rates. Relations between death rate, a_w and ammonia were similar in litter contaminated with *Salmonella typhimurium*. A number of samples of old and new litter were assayed for ammonia, moisture, pH and salmonellacidal activity. The highest activity obtained was a decrease of *S. typhimurium* from 9.2 X 10^9 cells/5g of litter to zero recovery within 11 days. The appearance of salmonellacidal activity in a sample of litter under test was observed to be accompanied by a rapid rise in ammonia and pH. In general, moisture, ammonia, and pH increased with the period of litter use, and salmonellacidal activity was a result of 2 principal factors: a_w unfavorable to salmonella cell viability; and high pH from ammonia dissolved in the available moisture of the litter. (Copyright 1973 - Avian Diseases)

4132-B2, D1, D3, E2

HOGS TO GET FLUSH TOILETS?

Anonymous
Nebraska Farmer, V. 118, No. 23, p. 21, Dec., 1976.

Keywords: Swine, Waste management, Flushing, Settling tanks, Lagoons, Irrigation, Wastewater reuse.

Norm Teter, Extension agricultural engineer at the University of Nebraska, predicted that hogs will soon get flush toilets. Evidence that the flushing process can be installed in all types of swine housing supports his prediction. In such flushing systems water is dumped at intervals to remove wastes from the building and deposit them in a settling tank. Solids sink to the bottom of the tank while the water runs over the top to a lagoon. The water may be pumped back and reused or pumped through an irrigation system or channeled down a ditch for ditch irrigation. Examples of swine waste disposal flushing systems, water release devices, and flushways are described. (Albertson-East Central)

4133-A2, B1, D1, D3, E2, E3

AWARDS MADE FOR WASTE MANAGEMENT STUDIES

Anonymous
Confinement, V. 2, No. 6, p. 17, June, 1977.

Keywords: Awards, Animal waste management, Runoff control, Vegetative filters, Recycling, Aerobic treatment, Anaerobic treatment, Land application, Wind erosion, Separation techniques.

The Livestock Environmental Sciences Committee recently recognized several people for their contributions to knowledge of relations between livestock production and the environment. Dwayne Lewis, a cattle feeder from Kearney, Nebraska was presented the Certificate of Achievement. Lewis's $150,000 runoff-control system includes wire debris traps to remove settleable solids. Dale H. Vanderholm conducted a research project on feedlot runoff control using vegetative filters. He was presented a Certificate of Achievement. Also presented the same award was James Converse on his project evaluating the use of livestock and poultry manure as an energy source, a feed ingredient, and a substitute fertilizer was also cited. J. P. Harper, P.O. Ngoddy and J. B. Gerrish at Michigan State University were merited the Certificate of Achievement also. Their paper involved screening of fibrous suspended solids in liquid manure from combined cattle and swine feeding operations to improve the efficiency of aerobic and anaerobic treatment. Recognized for their outstanding paper with the USDA at Manhattan, Kansas were N. P. Woodruff, L. Lyles, J. D. Dickerson and D. V. Armbrust. They were merited the LESC's Certificate of Achievement. Their paper dealt with a comparison of surface-applied and tilled-in manures from cattle feedlots and wheat stubble in controlling wind erosion. (Rowe-East Central)

4134-B2, B3, D1, E2, F1

COSTS OF DAIRY WASTE DISPOSAL ON TENNESSEE EXPERIMENT STATION FARMS

Department of Agricultural Economics and Rural Sociology, Universitv of Tennessee, Knoxville, Tennessee 37901
L. L. Bauer and J. I. Sewell
Tennessee Farm and Home Science, Progress Report 101, p. 12-15, Jan.-March, 1977. 2 tab., 2 ref.

Keywords: Dairy wastes, Waste management, Liquid wastes, Solid wastes, Lagoons, Equipment, Costs, Flushing, Irrigation, Land disposal.

The University of Tennessee Institute of Agriculture evaluated the various aspects of managing and disposing of waste on dairy farms. Five University of Tennessee Experiment Station farms were used to determine the economic and operational aspects of the various disposal systems. Some of the dairies used relatively new facilities while other used facilities not conducive to efficient waste management operations. Three types of disposal systems were used: liquid manure systems, hauled waste as solids, and lagoon systems. A complete tabular breakdown is given for the costs incurred in operating the waste management systems at each of the farms. The lagoon system proved to be the least costly per cow. Fertilizer value of dairy manure was not considered in the projection of annual cost of manure disposal given. (Albertson-East Central)

4135-A10, B1, B2, D2

TITLE: INSECT GROWTH REGULATORS: DEVELOPMENT OF HOUSE FLIES IN FECES OF BOVINES FED TH 6040 IN MINERAL BLOCKS AND REDUCTION IN FIELD POPULATIONS BY SURFACE TREATMENTS WITH TH 6040 OR A MIXTURE OF STIROFOS AND DICHLORVOS AT LARVAL BREEDING AREAS

Veterinary Toxicology & Entomology Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, College Station, Texas 77840
J. E. Wright
Journal of Economic Entomology, V. 68, No. 3, p. 322-324, June 16, 1975. 3 tab. 8 ref.

Keywords: Fly control, Biocides, Cattle manure, Feedlots, Swine wastes, Lagoons, Wastewater treatment plant, TH 6040, Stirofos, Dichlorvos.

Development of *Musca domestica* L. was inhibited in the feces of cattle that consumed mineral blocks which contained 0.1 and 0.5 percent of the insect growth regulator Thompson-Hayward 6040 N-(4-chlorophenyl) -N'-(2,6-difluorobenzoyl) urea . The application of TH 6040 or a mixture of 21.4 percent stirofos and 5.3 percent dichlorvos (Ravap) as area treatments to larval breeding sites at a swine feedlot (0.05 and 0.075 percent concn, respectively) and at a waste water treatment plant (0.05 and 0.15 percent concn, respectively) inhibited adult emergence throughout the fly breeding season. (Copyright 1975 - Journal of Economic Entomology)

4136-B3, B5, E2

INFLUENCE OF FARMYARD MANURE AND NITROGEN FERTILIZERS ON SOWN PASTURES, SEED YIELD AND QUALITY OF *Cenchrus ciliaris L.* AT KONGWA TANZANIA

Diocese of Central Tanganyika, Box 15, Dodoma, Tanzania
P. M. Wigg, M. A. Owen and N. J. Mukuarasi
East African Agricultural and Forestry Journal, V. 38, No. 4, p. 367-374, April, 1973. 1 fig., 6 tab., 6 ref.

Keywords: Land application, Application rates, Farmyard manure, Swards, Crop response, Weeds, Fertilizers, Nitrogen.

In an effort to rejuvenate sown pastures, four rates of farmyard manure were applied annually to a *Cenchrus ciliaris/Chloris gayana* pasture. Annual dressings of up to 62.5 metric tons/ha (25 tons/ac) gave considerable responses in overall yield. *C. gayana* disappeared from the pastures after three to four years irrespective of manure applied, while percentage of *Cenchrus ciliaris* in the sward declined with heavier rates of manure and was replaced by *Cynodon dactylon*. Weed content of the pastures was not increased by application of manure. In comparing manure with artificial nitrogen in another experiment, manure gave a smaller immediate response but had longer residual effect, with the overall yield increase after four years very similar. As manure application is impracticable, the use of night grazing or shifting night enclosures is suggested to spread fertility. Nitrogen fertilizer marginally improved total seeds of *Cenchrus ciliaris*, but did not improve seed quality. (Copyright 1973 - East African Agricultural and Forestry Journal)

4137-B2, C3, D3, E3

CHANGES IN MICROBIAL POPULATION DURING FERMENTATION OF FEEDLOT WASTE WITH CORN

Northern Regional Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Peoria, Illinois 61604
G. R. Hrubant
Applied Microbiology, V. 30, No. 1, p. 113-119, July 15, 1975. 1 fig., 6 tab., 12 ref.

Keywords: Feedlot wastes, Liquid wastes, Fermentation, Corn, Protein synthesis, Yeasts, Lactobacilli, Recycling, Refeeding.

A new process for recycling feedlot waste involves the fermentation of liquid from this waste combined with corn. Changes in the flora of this silage-like fermentation were followed. The fermentation was dominated by lactobacilli and yeasts, which initially constitute 1 percent or less of the natural flora. The species of yeasts and lactics involved were characterized. The fermentation has two phases. A single heterolactic species multiplied rapidly for the first 24 h until it represented 95 percent of the lactobacilli and more than 90 percent of the total microflora. It displaced the betabacterium predominant among lactics of the original waste; the acid produced killed coliforms and other organisms in feedlot waste; and the acetic acid produced probably caused the death of the dominant native yeast *Trichosporon cutaneum* (de Beurm., Gougerot et Vaucher) Ota. The peak lactobacillus count remained constant (about 2 X 10^9 organisms/g [wet weight]) throughout the rest of the fermentation. Homolactics dominated the later phase and yeasts increased to 9.5 X 10^7 organisms/g (wet weight). At 6 days, a stable mixture of three lactobacilli was present, one streptobacterium, one thermobacterium, and one betabacterium. Similarly, yeasts stabilized as a mixture of two *Candida* sp. and one *Pichia* sp. The dominant species of lactics were characterized. Information on the sequence of microorganisms provides a basis for enhanced protein synthesis in the fermentation. (Copyright 1975 - Applied Microbiology)

4138-B3, C1, E3, F1

RESPONSE OF DAIRY CATTLE GIVEN A FREE CHOICE OF FREE STALL LOCATION AND THREE BEDDING MATERIALS

Animal Physiology and Genetics Institute, Agricultural Research Center, USDA, Beltsville, Maryland 20705
J. E. Keys, Jr., L. W. Smith, and B. T. Weinland
Journal of Dairy Science, V. 59, No. 6, p. 1157-1162, 1976. 1 fig., 4 tab., 4 ref.

Keywords: Solid wastes, Sawdust, Dairy manure, Dewatered manure, Dehydrated manure, Moisture content, Bedding, Dairy cattle, Free stalls, Costs.

Dewatered manure solids (29 percent dry matter), dehydrated manure solids (90 percent matter), and sawdust (81 percent dry matter) were compared as bedding materials for dairy cattle allowed free choice of the bedding materials in free stalls. The three bedding materials were placed in three free stall sections of nine stalls each and were rotated at the beginning of three consecutive week-long periods. Nine lactating dairy cows were placed in the 27 free stall barn and observed for 48 h during each of the three periods via a TV camera-video tape recording system. A trial during late winter was repeated during midsummer. Cows spent 13.3 h/day lying in free stalls during the winter trial and 5.9 h/day during the summer trial. Cows spent an average of .5, 6.6, and 6.2 h/day lying on dewatered manure solids, and sawdust during the winter trial and .5, 3.4, and 2.0 h/day during the summer trial. The relative cost of producing an amount of the above respective bedding materials to fill one 122 X 213 cm free stall to a depth of 10 cm was \$2.63, \$11.46, and \$1.27. (Copyright 1976 - Journal of Dairy Science)

4139-A2, A4

VARIATION IN THE DENSITY OF POLLUTION INDICATOR BACTERIA IN THE COTTONWOOD RIVER AS RELATED TO FEEDLOT RUNOFF

L. J. Kennedy
M.S. Thesis, Kansas State Teachers College, Aug., 1971, 54 p. 6 fig., 25 tab., 16 ref.

Keywords: Water pollution, Cottonwood River, Feedlots, Agricultural runoff, Pollutant identification, Fecal coliforms, Sewage.

The Cottonwood River (in the vicinity of Emporia, Kansas) was monitored from May, 1967 to July, 1968 to determine the relationship between feedlot runoff and population density of indicator bacteria and to establish seasonal "norms" for bacterial density in the river. Sampling was periodically conducted at 5 river stations and 2 effluent stations. It was determined that one-half inch rainfall was the minimum, which would result in excessive feedlot runoff entering the river. While minimal densities of fecal bacteria existed during periods of no runoff, an overall station-to-station increase in microbial population was found to occur as the water moved through the study area. The last station had the highest microbial population, but this was mainly attributed to contamination from the nearby Emporia Sewage Disposal Plant. Highest numbers of fecal bacteria were found at stations below the point where feedlot effluents entered the river. During runoff events, these downstream stations had dangerously high populations of indicator organisms. Populations reached densities approximating 1.2 million fecal coliforms per 100 ml sample. These drastically elevated numbers of indicator organisms declined to 28,000 fecal coliforms per 100 ml sample by the time the water reached the last monitoring station (approximately 2 miles below the feedlots), indicating that a rapid dispersal of fecal bacteria occurred as the stream flowed away from the source of contamination. (Albertson-East Central)

4140-B2, C2, D3, E3

THERMOPHILIC METHANE PRODUCTION FROM CATTLE WASTE

Department of Dairy Science, University of Illinois, Urbana, Illinois 61801
V. H. Varel, H. R. Isaacson, and M. P. Bryant
Applied and Environmental Microbiology, V. 33, No. 2, p. 298-307, Feb., 1977. 7 fig., 6 tab., 20 ref.

Keywords: Anaerobic digestion, Cattle wastes, Slurries, Methane, Temperature, Volatile solids.

Methane production from waste of cattle fed a finishing diet was investigated, using four 3-liter-working volume anaerobic digestors at 60°C. at 55°C a start-up culture, in which waste was the only source of bacteria, was generated within 8 days and readily adapted to 60°C, where efficiency of methanogenesis was greater. Increasing the temperature from 60 to 65°C tended to drastically lower efficiency. When feed concentrations of volatile solids (VS, organic matter) were increased in steps of 2 percent after holding for 1 month at a given concentration, the maximum concentrations for efficient fermentation were 8.2, 10.0, 11.6, and 11.6 percent for the retention times (RT) of 3, 6, 9, and 12 days, respectively. The VS destructions for these and lower feed concentrations were 31 to 37, 36 to 40, 47 to 49, and 51 to 53 percent for the 3-, 6-, 9-, and 12-day RT digestors, respectively, and the corresponding methane production rates were about 0.16, 0.18, 0.20, and 0.22 liters/day per g of VS in the feed. Gas contained 52 to 57 percent methane. At the above RT and feed concentrations, alkalinity rose to 5,000 to 7,700 mg of $CaCO_3$ per liter (pH to 7.5 to 7.8), NH_3 plus NH_4^+ to 64 to 90 mM, and total volatile acids to 850 to 2,050 mg/liter as acetate. The 3-day RT digestor was quite stable up to 8.2 percent feed VS and at this feed concentration produced methane at the very high rate of 4.5 liters/day per liter of digestor. Increasing the percentage of feed VS beyond those values indicated above resulted in greatly decreased organic matter destruction and methane production, variable decrease in pH, and increased alkalinity, ammonia, and total volatile acid concentrations, with propionate being the first to accumulate in large amounts. In a second experiment with another lot of waste, the results were similar. These studies indicate that loading rates can be much higher than those previously thought useful for maximizing methanogenesis from cattle waste. (Copyright 1977-Applied and Environmental Microbiology)

4141-A11, B1
HOUSING AND FLOOR DESIGN CAN INFLUENCE PIG PERFORMANCE

Anonymous
Kansas Farmer, V. 113, No. 15, p. 47, Sept. 4, 1976.

Keywords: Housing, Slatted floors, Swine, Performance, Concrete lots, Dirt lots, Feed lots, Confinement pens.

Animal science researchers at South Dakota State University studied floor designs and housing types to evaluate their effects on pig performance. Researchers conducted 2 separate trials using 5 treatments that were replicated 4 times. Pigs in treatments 1, 2, and 3 were housed in an enclosed confinement building with fully slatted floors. One treatment was pigs on 8-inch concrete slats, another was pigs on 5-inch concrete slats, and another was on 3½-inch slats. Treatment 4 was pigs housed in uninsulated, wooden-floored houses and fed and watered outside in dirt lots. Treatment 5 was in similar houses but with outside concrete lots. The first trial was run during the summer and the second trial was run during late summer and fall. Pigs given access outside on concrete gained faster during the finishing phase from 125 to 220 pounds. Slat size appeared to make very little difference in performance. When researchers learned that slats sizes did not appear to affect performance, they then compared pigs on slats to pigs grown in open front buildings with access to the outside. Pigs housed in outside concrete lots gained faster and required less feed per pound of gain than those housed inside. (Albertson-East Central)

4142-B1, B4, B5, C2, E2
SPREAD THE MUCK AROUND THE FARM

S. N. Adams
Agriculture in Northern Ireland, V. 50, No. 9, p. 250-251, 2 fig.

Keywords: Livestock wastes, Land spreading, Nutrients, Fertilizers.

To get full fertilizer value from livestock manure, it must be properly spread around the farm. Diagram 1 illustrates the wrong way to distribute manure. In this diagram, the manure is considered a waste product to be dumped. Leakage caused loss of nutrients from the manure heap. Diagram 2 illustrates the right way to distribute manure. There is no leakage from the manure heap and the manure is spread over the whole farm, especially on the cutting ground. Need for commercial fertilizer is greatly reduced. (Albertson-East Central)

4143-B3, E3, F1
MORE INTEREST EVIDENT IN POULTRY LITTER AS LESS COSTLY, MORE AVAILABLE FERTILIZER

Anonymous
Feedstuffs, V. 49, No. 1, p. 5, Jan. 3, 1977.

Keywords: Litters, Poultry, Fertilizers, Refeeding, Economics.

Charles F. Thomas, extension poultry scientist, Auburn University, reported that poultry manure (including litter), correctly handled and conserved, is the richest in plant food and the most valuable of all manures produced by livestock. High costs of fertilizer, coupled with shortages of fertilizer ingredients, have increased interest in the use of poultry litter as a fertilizer rather than as a recycled feed ingredient. A cost review and an analysis of the recycled material in relation to its value as a fertilizer and its value as a recycled feed ingredient are given. (Albertson-East Central)

4144-B2, C2, D3, E1
OVERLAND FLOW PRETREATMENT OF POULTRY MANURE

Biological and Agricultural Engineering Dept., North Carolina State University, Raleigh, North Carolina 27607
M. R. Overcash, F. J. Humenik, P. W. Westerman, D. M. Covil, and J. W. Gilliam
Paper No. 76-4517, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 23 p. 4 fig., 12 tab., 22 ref.

Keywords: Overland flow pretreatment, Poultry wastes, Physical treatment, Biological treatment, Loading rates, Flow rate, Nitrogen, Sampling, Land use.

Study objectives were: (1) to evaluate the concentration and mass changes of waste parameters in poultry waste as affected by overland flow (OLF) with distances from 15 m to 45 m, and (2) to project a farm-scale system which utilizes OLF as a poultry waste pretreatment. A field installation consisting of a caged layer house, overland flow terraces, and two lagoons was constructed. Flushed wastes from the caged layer house were strained and agitated before being pumped to a terrace overland flow system seeded with a mixture of Reed Canary, redtop, and fescue grass seed. The 3 basic parameters that were considered under which to establish different loading conditions from each terrace system were: (1) frequency of loading, (2) flow rate, and (3) total nitrogen load. Wastewater loading samples, wastewater runoff samples, groundwater samples, and grass samples were taken. Substantial losses of nitrogen via wastewater runoff, rainfall runoff, grass uptake, soil water, ammonia volatilization, denitrification, soil sorption, and microbial assimilation during overland flow pretreatment indicated that OLF can serve to substantially reduce the total land area for waste management. OLF would appear to reduce land needs by 50-70 percent and when followed by a flush recycle retention pond results in an 80 percent land area reduction. Effluent quality from OLF or OLF-lagoon systems for poultry manure or animal waste would not be sufficiently treated for direct disposal into streams. (Albertson-East Central)

4145-A11, B3, C2, E3
NUTRIENT CHARACTERIZATION OF SWINE FECAL WASTE AND UTILIZATION OF THESE NUTRIENTS BY SWINE

Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
E. T. Kornegay, M. R. Holland, K. E. Webb, K. P. Bovard and J. D. Hedges
Journal of Animal Science, V. 44, No. 4, p. 608-619, April, 1977. 8 tab., 25 ref.

Keywords: Swine wastes, Nutrients, Refeeding, Unprocessed swine feces, Dried swine feces, Digestibility, Minerals, Rations, Performance, Amino acids, Energy.

Swine feces from finishing hogs were fed in two metabolism trials by substituting for 21.7 and 37.3 percent (dry matter) of a basal corn-soybean meal ration. Unprocessed feces (fresh) were used in one trial and dried feces were used in the other trial. Feces collected from gilts fed rations containing feces had significantly higher levels of crude fiber, ether extract and gross energy, and significantly lower levels of crude protein and true protein than feces collected from gilts fed the basal ration. The fecal concentration of ash, NFE and nonprotein nitrogen tended to remain constant as percent of feces increased in the ration. The fecal concentration of amino acids in most cases decreased as feces were substituted. Although the intake of all minerals increased as the percent of feces increased in the ration, only the fecal concentration of magnesium, copper and zinc were significantly higher with the concentrations of calcium, phosphorus and potassium remaining about constant. Phosphorus was the only urinary component which significantly increased as the level of feces substituted in the basal ration increased. Output of feces increased as the amount of feces substituted for the basal ration was increased with no differences in urinary output. Swine feces were found to be of less nutritive value than a basal corn-soybean meal ration. Digestibilities for dry matter, energy, ash, crude fiber, ether extract, crude protein, true protein and nitrogen-free extract, calculated by difference using the percentage of that nutrient which was from feces, were: 48.0, 46.7, 31.6, 40.9, 54.1, 60.1, 51.4 and 45.9 percent respectively. With the exception of serine, glycine and cystine, in which the digestion coefficients were lower, the digestibilities of the other amino acids ranged from 51.2, to 65.1 percent. The apparent absorption of most minerals analyzed was reduced as the level of dietary feces substituted increased (the intake of all minerals increased as feces substituted increased), but absorption and retention, in grams per day, were similar or greater as feces were substituted for the basal ration. (Copyright 1977 - Journal of Animal Science)

4146-A11, B2, B3, C2, E3
COMPOSITION OF CORN PLANT ENSILED WITH EXCRETA OR NITROGEN SUPPLEMENTS AND ITS EFFECT ON GROWING WETHERS

U.S. Department of Agriculture, Beltsville, Maryland 20705
H. K. Goering and L. W. Smith
Journal of Animal Science, V. 44, No. 3, p. 452-461, March, 1977. 8 tab., 25 ref.

Keywords: Rations, Silage, Ensiling, Refeeding, Urea, Soybean meal, Dried poultry excreta, Cattle manure liquid, Corn, Sheep, Performance, Crude protein, Nitrogen, Lactic acid, Digestibility.

Either urea, soybean meal, dried poultry excreta, or liquid expressed from cattle manure was added to whole plant corn forage at levels that would approximate 12 percent crude protein in the dry matter and ensiled in 1.22- X 2.44-m silos. The actual crude protein concentration of the four silages was 10.9, 10.4, 10.1 and 11.2 percent in dry matter. Recovery of corn forage dry matter and supplements after storage for 90 days was 93, 100, 89 and 94 percent. Recovery of sugar was 21, 29, 16 and 19 percent. Ammonia nitrogen increased 7.5-fold during storage for the soybean meal supplemented silage. Hot-water insoluble nitrogen was 33, 50, 41 and 46 percent of total nitrogen for urea, soybean meal, dried poultry excreta and the liquid expressed from cattle manure treatments. Percentage of lactic acid in dry matter was 4.5, 4.1, 5.9 and 7.6. The pH value was 3.9, 3.9, 4.2 and 3.8. The silages were fed to 16 wethers for 63 days in a growth trial.During 7 days of the trial, total urine and feces from all sheep were collected. Dry matter digestibility was 66, 64, 63 and 64 percent. Organic matter digestibility was 68, 65, 65 and 65 percent. Nitrogen retention was .8, .1, 3.1, and 2.1 g/day. Weight gain was 3, 48, 132 and 101 g/day. Daily organic matter consumed was 28, 28, 35 and 29 g/kg$^{.75}$. The superior performance of lambs fed on the dried poultry excreta silage was a result of increased intake over the urea and soybean meal treatments, but rate of gain was greater for lambs fed the liquid cow manure silage than the urea and soybean meal treated silage, even with similar organic matter intakes. (Copyright 1977 - Journal of Animal Science)

4147-A11, B1, C1, C2, D3

EFFECT OF ARSANILIC ACID IN SWINE DIETS ON FRESH WASTE PRODUCTION, COMPOSITION AND ANAEROBIC DECOMPOSITION

Purdue University, West Lafayette, IN 47907
M. C. Brumm, A. L. Sutton, V. B. Mayrose, J. C. Nye and H. W. Jones
Journal of Animal Science, V. 44, No. 3, p. 521-530, April, 1977. 3 fig., 8 tab., 24 ref.

Keywords: Arsenic, Arsanilic acid, Diets, Swine, Waste production, Chemical properties, Physical properties, Anaerobic decomposition.

A complete random design experiment was conducted to determine the effect of arsanilic acid in swine diets on fresh waste production and composition and on decomposition of the waste stored in anaerobic pits. Vitamin and mineral fortified corn-soybean meal diets with 0, 100, or 200 ppm arsanilic acid were fed to growing-finishing pigs (14 to 91 kg) in winter and summer trials with daily fresh waste collection and addition to anaerobic pits. Average daily total waste production (wet basis) per pig, including hair, dust, wasted feed, waste water and excreta, was 3.8 kg during the winter trial and 4.8 kg during the summer trial. Average elemental arsenic excretion ranged from 35.7 mg to 62.9 mg per head per day. Arsenic concentrations (wet basis) in the anaerobic waste from pigs fed the 0, 100 and 200 ppm arsanilic acid diets for both trials were .54, 6.29 and 11.23 ppm, respectively. The presence of arsanilic acid in swine diets did not affect fresh waste production or composition. Arsanilic acid did enhance the decomposition of waste as shown by the reduction of dry matter and volatile solids in waste from arsanilic acid fed pigs. Dry matter content was reduced more than 60 percent in each trial in anaerobically stored waste from pigs fed arsanilic acid, while the dry matter content was reduced 23 percent and 39 percent in the waste from pigs fed the control diet. The presence of arsenic in the waste resulted in the retention of more total nitrogen (dry basis) and nitrogen in the ammonium form compared to waste with no arsenic but did not affect phosphorus, potassium and nitrate nitrogen levels. (Copyright 1977 - Journal of Animal Science)

4148-A11, B3, C1, C2, E3

PERFORMANCE OF BEEF CATTLE FED WASTELAGE AND DIGESTIBILITY OF WASTELAGE AND DRIED WASTE DIETS

Coastal Plain Experiment Station, Tifton, Georgia 31794
G. L. Newton, P. R. Utley, R. J. Ritter and W. C. McCormick

Journal of Animal Science, V. 44, No. 3, p. 447-451, March, 1977. 5 tab., 14 ref.

Keywords: Cattle, Diets Wastelage, Dried wastes, Performance, Digestibility, Refeeding, Nitrogen balance.

Feeding and digestion trials were conducted to evaluate the effects of inclusion of cattle waste in cattle diets. Eighteen heifers averaging 210 kg were individually fed either a control diet or a wastelage diet containing 40 percent wet cattle waste. Control heifers gained an average of 1.34 kg/day and required 5.02 kg feed dry matter/kg gain while those fed wastelage gained 1.27 kg/day and required 5.40 kg feed dry matter/kg gain (equivalent to 4.63 control mixture plus .77 kg manure). Control heifers had a significantly higher *ad libitum* mineral mixture intake than those fed wastelage. Proximate analysis of 16 weekly samples indicated that the composition of the wastelage was not greatly different from, nor more variable than, the control diet. In the digestion trial, six steers were fed either the control, the wastelage or a dried waste diet in a replicated 3 X 3 latin square design. The waste supplied 13.1 percent of the dry matter in the waste containing diets. Apparent digestibility of dry matter, nitrogen, ether extract, crude fiber, and NFE and nitrogen balance was: 76.1, 70.8, 69.6, 42.5, and 82.1 percent and 30.0 g for the control diet; 73.7, 67.2, 68.2, 41.2, and 81.7 percent and 16.3 g for the wastelage diet; and 72.1, 59.2, 64.9, 40.7 and 80.3 percent and 15.7 g for the dried waste diet. Nitrogen balance for both waste containing diets was significantly different from the control while dry matter and nitrogen digestibilities for the dried waste diet were significantly lower than for the control diet. When calculated by difference, the digestibilities for dry matter, nitrogen, ether extract. crude fiber and NFE were 57.7, 34.2. 9.0. 31.6 and 83.5 percent and 45.2, 2.7, 2.9, 34.9 and 68.3 percent for the fermented and dried wastes respectively. (Copyright 1977 - Journal of Animal Science)

4149-A7, A12, B1, C2

HOG CONFINEMENT GASES CAUSE MEDICAL PROBLEMS

Anonymous
Prairie Farmer. V. 149, No 7, p. 50, April 2, 1977.

Keywords: Swine, Confinement pens, Gases, Health. Slatted floors, Manure pits, Explosions.

Dr. Kelly Donham, Assistant Professor with the Institute of Agricultural Medicine at the University of Iowa Medical School, reports that concerned doctors prompted a preliminary study of confinement facilities equipped with slatted floors and manure pits. Gases emitted cause producers working with hogs to suffer from headaches, shortness of breath, phlegm, stuffy nose, dizziness, and vomiting. There have even been deaths and building explosions reported. About 50 gases can be identified in the air of these units, five of which are potentially dangerous to the producer. These include carbon monoxide, carbon dioxide, ammonia, methane, and hydrogen sulfide. Most of these come directly from the manure and fermentation of the manure in the pit, but heating units in the facility are responsible for the carbon monoxide and carbon dioxide leakage. Since the buildings are more tightly sealed in cold weather, the gases present a greater problem in the winter. Donham suggests that at least one of the fans in a unit be run on a timer instead of a thermostat. (Hudson - East Central)

4150-A1, A6, B1

POLLUTION RESEARCHERS FINDING MANY ANSWERS, EXPERT REPORTS

Anonymous
Beef, V. 8, p. 34, Jan., 1972.

Keywords: Pollution, Odor, Livestock, Feedlots. Agricultural run-off, Manure pack, Land application.

Myron D. Paine, a Kansas regional extension specialist in feedlot waste management, spoke at a feeders conference conducted by the Kansas Livestock Association and had this advice for cattlemen: (1) When handling run-off watch out for the solids. Solids need to be settled out before entry of run-off into detention ponds. (2) If state regulations don't give a specific time limit on pumping down the reservoir, don't pump any faster than is necessary. (3) Adequate drainage is the best single protection against feedlot odors. (4) Spray application of the liquid may not be desirable because of odor. (5) Some solid wate on the surface of the feedlot may be desirable -- if it is kept at 30-40 percent moisture content. The manure pack allows about 55 percent of the carbon to disappear into the air and it also lessens the amount of soil removed in cleaning. (6) Research indicates manure can be applied to crops at rates ranging from 10 to 40 tons per acre per year. (7) Excess salt should be kept out of the feedlot ration. (Albertson - East Central)

4151-A6, A10, B2, E1

POULTRY WASTE GOES DOWN THE DRAIN

V. Miller
Progressive Farmer, V. 92, No. 5, p. 61, May, 1977.

Keywords: Poultry wastes, Lagoons, Flushing, Fly control, Odor control, Wastewater reuse, Tile disposal field, Overflow pond.

Father Bernard, head of the farming operation at Mepkin Abbey, a Trappist Monastery near Moncks Corner, South Carolina, relies on a flush system which utilizes a series of lagoons, a tile disposal field, and an overflow pond. The operation is an odor-free, fly-free poultry waste disposal system. Poultry houses are flushed several times a day, but each flushing probably adds no more than five minutes to the workload. The object of flushing several times a day and of having separate drain pipes into the lagoons from each of the six houses is to load the lagoons evenly and hold down odor. Recycled lagoon water cuases some odor in the houses during flushing, but not as much as the old pit scraping system. All alleys are swept once a day so feathers, spilled feed, broken eggs, and other trash also are flushed into the lagoon system. The pump must be cleaned twice a year and dismantled. The parts are sprayed with a nonstick plastic material to slow down the buildup of salt crystals that can clog the pump. (Albertson-East Central)

4152-A6, A7, B1, C2, F2
ODORS FROM CONFINED LIVESTOCK PRODUCTION

Agricultural Engineering Department, Oregon State University, Corvallis, Oregon 97331
J. R. Miner
Environmental Protection Agency Report, EPA-660/2-74-023, April, 1974, 125 p. 6 fig., 33 tab., 86 ref.

Keywords: Odor control, Livestock, Legal aspects, Confinement pens, Cattle, Hogs, Poultry, Hydrogen sulfide, Ammonia, Chemical treatment, Waste storage, Field spreading.

Current livestock production techniques result in the generation of odors which have become the source of conflict between livestock producers and society. The odorous gases responsible for the nuisance are principly low molecular weight compounds released during anaerobic decomposition of manure. Manure management systems which control or modify this decomposition offer the greatest potential for odor control. Research to identify the chemical compounds present in odorous air from animal waste degradation has yielded about 45 compounds a day. The amines, mercaptans, organic acids and heterocyclic nitrogen compounds are generally regarded as being of greatest importance. Among the techniques for odor control are: (a) site selection away from populated areas and where adequate drainage exists, (b) maintain the animal areas as dry as possible and prevent the animals from becoming manure covered, (c) select manure handling system which utilize aerobic environments for manure storage, (d) maintain an orderly operation free of accumulated manure and runoff water, (e) practice prompt disposal of dead animals, and (f) use odor control chemicals when short-term odor is necessary, such as when manure storage tank contents must be field spread. (Environmental Protection Agency)

4153-B2, B3, D1, D2, E3, F1
MAKING THE MOST OF WASTE

Anonymous
Feedstuffs, V. 49. No. 10, p. 22, 24, March 7, 1977. 3 fig.

Keywords: Poultry wastes, Cattle wastes, Recycling, Methane, Fertilizers, Refeeding, Irrigation, Extrusion, Chemical treatment, Physical treatment, Sterilization, Economics.

South Carolina's Dew Fresh Eggs Corporation will completely recycle waste from poultry and cattle within the confines of its farm. Twenty-seven hundred acres of timberland are being cleared to produce feed grain and pasture for the corporation's beef cattle. A methane plant will intercept most of the poultry and cattle waste before it is diverted to fertilizer use on the adjacent fields. Waste from the layer and beef operations will be spread onto most of the 2700 acres. The recovery process installed at Dew Fresh mechanically extrudes the waste to separate the water from the solid fraction. The solid fraction can be alternately refed or spread on crop land and pastures. The liquid fraction moves on to the methane generator, where the gas is pulled off and liquid is pumped to a traveling gun-type sprinkler irrigation system that spreads the nutrient-loaded water. Though the methane digester at Dew Fresh is designed to be economically feasible for a feedlot of 10,000 head, Richard Bunger, president of Phoenix, Arizona's Corral Industries, thinks this type of equipment may be scaled down in the future to fit operations with as few as 2,000-3,000 head. If that happens, even the smaller livestock feeders could benefit from this new level of technology. Bunger, whose company developed the confinement facility and methane plant design at Dew Fresh, is investigating the sterilization of the waste material with several types of chemical treatments for the purpose of refeeding the wastes. These methods should be cheaper than sterilization by dehydrating with gas under current prices, thus allowing producers to recycle the wastes in the most effective way of all -- refeeding. (Albertson - East Central)

4154-A11, C3
ISOLATION OF *ERYSIPELOTHRIX RHUSIOPATHIAE* FROM SOIL AND MANURE OF SWINE-RAISING PREMISES

National Animal Disease Laboratory, Veterinary Sciences Research Division, Agricultural Research Service, U. S. Department of Agriculture, Ames, Iowa 50010
R. L. Wood and R. A. Packer
American Journal of Veterinary Research, V. 33, p. 1611-1620, Aug., 1972. 11 fig., 3 tab., 24 ref.

Keywords: Swine wastes, Sampling, Pathogenic bacteria, Diseases, *Erysipelothrix rhusiopathiae*.

An investigation was conducted to determine whether *Erysipelothrix rhusiopathiae* could be found in the soil and manure of swine-raising premises. Samples of soil and manure were collected from swine pens on 19 farms in Iowa, and were examined by bacteriologic cultural technique for the presence of *E. rhusiopathiae*. Isolates positively identified as *E. rhusiopathiae* on the basis of growth and biochemical characteristics were obtained from 18 farms. The organism was found in 116 of 453 samples (25.6 percent) of soil or manure from swine pens on 11 farms where swine erysipelas had been diagnosed within the previous 9 months and in 50 of 133 samples (37.6 percent) from 8 farms where the disease had not been observed for at least 5 years. Of 166 locations, 158 (95.2 percent) were pathogenic for swine. (Copyright 1972 - American Journal of Veterinary Research)

4155-A10, C3
ADDITIONAL INSECTS ASSOCIATED WITH BOVINE DROPPINGS IN KERR AND BEXAR COUNTIES, TEXAS

Entomology Research Division, Agricultural Research Service, USDA, Kerrville, Texas 78028
Richard R. Blume
Journal of Economic Entomology, V. 65, No. 2, p. 621, 1972. 1 tab., 6 ref.

Keywords: Cow manure, Insects.

Based on the data collected during studies in Texas of the ecology of the horn fly, *Haematobia irritans* (L.), in Kerr County, (Blume et. al. 1970) and in Bexar County (Kunz et. al. 1970), 103 insect species representative of 45 families of 5 orders were reported as having been collected from bovine droppings (Blume 1970). Table 1 of the present study lists 23 additional insect species collected from bovine droppings, making a total of 126 insect species representative of 48 families and 5 orders. The scarabaeids listed in Table 1 are all coprophagous species and are important competitors with such dung-breeding insects of veterinary significance as the horn fly. The braconid *Aphaereta pallipes* (Say) is important because it is a pupal parasite of the horn fly (Combs and Hoelscher 1969) as well as the face fly. *Musca autumnalis* De Geer (Houser and Wingo 1967, Valiela 1969). (Copyright 1972 - Journal of Economic Entomology)

4156-A6, B1, F2
ODORS MAY LEAD TO COURTROOM

University of Missouri, Columbia, Missouri 65201
C. Fulhage
Missouri Ruralist, V. 118, No. 3, p. 46-47, Feb. 12, 1977.

Keywords: Odor, Legal aspects, Liquid wastes, livestock wastes, Site selection, Odor control.

Odors are a primary concern in the environment as evidenced by increased complaints received by state regulatory personnel in the Air Quality Program of the Missouri Department of Natural Resources. The Air Quality Program of the Department of Natural Resources drafts and enforces guidelines to maintain air quality in Missouri. A scentometer is used to determine if livestock odors exceed allowable levels. A nuisance suit may be filed by anyone who feels livestock odors are interfering with enjoyment of his property. Odors generated by unstabilized (fresh) manure when exposed to air, open lots, open feeding floors and liquid manure spreading operations are very conducive to odor development. Use of good housekeeping methods and/or bacterial additives will help control odors in open lots and floors. Knifing manure into the soil will help control odor when manure is being spread. Prevailing wind direction and nearness to neighbors are factors which must be considered when selecting feedlot sites. (Albertson-East Central)

4157-A2, A8, B2, B5, C2, E2
KANSAN APPLIES FEEDLOT RUN-OFF TO CORN FIELDS

Anonymous
Beef, V. 9, p. 6, Sept., 1972

Keywords: Feedlots, Agricultural runoff, Land application, Crop response, Nitrates, Salts.

Harry Manges of Kansas State University, at the Pratt (Kansas) Feedlot discusses the use of feedlot runoff on field crops. After two years of treatments, the best corn forage yields were obtained from fields receiving four to eight inches of feedlot runoff, plus other irrigation water as needed. Yields began to drop when feedlot runoff went over the eight-inch level. Even at the four-inch level, the level of nitrates and other salts began to build up in the soil. Material in feedlot runoff varies tremendously, depending on the season, the particular lot, soil conditions, and even the housekeeping ability of the feedlot operator, and should be checked. (Albertson-East Central)

4158-B1, D3, E3, F1

MANURE TO METHANE . . . IS IT FEASIBLE?

D. R. Brown
Western Livestock Journal, V. 55, No. 22, p. 60, March, 197.

Keywords: Manure, Recycling, Methane, Anaerobic digestion, Feeds, Fertilizers, Economics.

Animal waste disposal may be part of the solution to our present energy shortage. Hamilton Standard Company, Hartford, Connecticut, has been hired by San Francisco Utility and Southern California Gas Company to determine what kinds of facilities would be needed to convert animal wastes to fuel. Converting manure to methane involves an anaerobic digestion process similar to that used in sewage disposal plants. Anaerobic digestion goes through two stages. Acid is formed in the first stage by bacteria. A second strain of bacteria forms methane gas from the acid. After the gas is formed and removed, a sludge remains that has two uses. Fifteen percent of the residue can be recycled back into the cattle feed. The remaining portion is considered good fertilizer and has commercial value. If the process is deemed feasible, private enterprises such as cattle feeders and public service companies must realize that through joint efforts and mutual concerns, each can prosper in business and still efficiently use our vital energy sources. (Albertson-East Central)

4159-B3, C2, E3, F1

INTEREST IN DPW APPEARS TO HAVE SUBSIDED

Anonymous
Poultry Digest, V. 36, No. 422, p. 195, April, 1977.

Keywords: Dried poultry wastes, Recycling, Refeeding, Poultry, Cattle, Fertilizers, Nutrients, Economics.

Accelerating energy and investment costs, legal implications, and a return to reasonable fertilizer and feed ingredient process are major factors in the declining interest in dehydration of caged layer manure. Competition from commercial fertilizers and bagged cattle and sheep manures has limited dehydrated poultry wastes (DPW) sales in the lawn and garden trade. Recycling DPW back through poultry has created some interest. However, poultry manure is quite low in energy. Much of the nitrogen occurs in a nonprotein nitrogen form such as uric acid and is unavailable to the chicken. DPW from different sources may vary widely in composition and nutrient values. Factors contributing to this wide variation include the amount of waste feed and feathers in the manure, the age and treatment of manure being dried, drying temperature, ration composition and age of birds producing the manure. Dehydration of manure appears to offer potential only to those few large organizations controlling both poultry production and cattle feed manufacturing operations. The use of poultry manure as a feed ingredient for ruminants appears to have great potential. (Albertson - East Central)

4160-B1

KSU TRIES PLASTIC SLATS AND WALLS IN PIG NURSERY

Anonymous

Kansas Farmer, V. 115, No. 8, p. 43, April 16, 1977. 1 fig.

Keywords: Swine, Slats, Management.

Kansas State University swine researchers found that concrete slats in the University's swine nursery unit began to break apart after eight years of constant use. Possible reasons include improper concrete mix, constant exposure to moisture, improper sealing, high-pressure cleaning, and a caustic reaction to urine and feces. The concrete floor was replaced with 3-inch-wide plastic slats spaced alternately three-eights inch and one inch apart. The galvanized sheet metal lining the walls was replaced with a white plastic liner. (Albertson - East Central)

4161-C3

ISOLATION AND IDENTIFICATION OF FECAL BACTERIA FROM ADULT SWINE

Department of Animal Physiology and Growth, Biological Sciences, Research Center, Shell Development Company, Modesto, California 95352
J. P. Salanitro, I. G. Blake and P. A. Muirhead
Applied and Environmental Microbiology, V. 33, No. 1, p. 79-84. Jan., 1977, 4 tab., 28 ref.

Keywords: Swine wastes, Microorganisms, Bacteria, Isolation and identification techniques, Anaerobic culture methods, Rumen fluid.

An examination of the fecal microflora of adult swine was made with regard to the efficiency of several roll tube media in enumeration and recovery of anaerobes, the effects of medium constituents on recovery, and the isolation and identification of the predominant kinds of bacteria. Total number of organisms by microscopic bacterial counts varied among fecal samples from 4.48 x 10^{10} to 7.40 x 10^{10} bacteria/g (wet weight). Comparison of different nonselective roll tube media indicated that about 30 percent of the fecal bacteria could be recovered with a rumen fluid (40 percent, vol/vol) medium (M98-5). Recoveries of 21 and 15 percent, respectively, were obtained with M10 and rumen fluid-glucose-cellobiose agar (RGCA) media. Rumen fluid, Trypticase, sugars, and CO gas phase were important components required for maximum recovery with this medium. Similar high recoveries of anaerobes were also obtained with M98-5 containing swine cecal extract of place in rumen fluid of M10 plus swine cecal extract. Significantly lower recoveries were observed with BCGA, media supplemented with swine fecal extracts, reinforced clostridial medium, brain heart infusion agar, and prereduced blood agar. Ninety precent of the bacteria isolated from roll tube media were gram positive and consisted of facultatively anaerobic streptococci, *Eubacterium* sp., *Clostridium* sp., and *Propionibacterium acnes*. The remainder of the flora (8 percent) included several other species of anaerobes and *Escherichia coli*. Rumen fluid (or volatile fatty acids), Trypticase, and yeast extract additions to basal media stimulated the growth of anaerobic strains. Variation in the relative proportions of the predominant fecal microflora was observed. This work indicates thatsatisfactory enumeration, isolation, and cultivation of the predominant microflora in swine feces can be obtained when strict anaerobic culture methods and a rumen fluid medium are used. (Copyright 1977 - Applied and Environmental Microbiology)

4162-A7, B1

RELATIVE AND QUALITATIVE ASPECTS OF AERIAL BACTERIA AND DUST IN SWINE HOUSES

University of Illinois at Urbana-Champaign, Urbana, Illinois 61801
S. E. Curtis, J. G. Drummond, D. J. Grunloh, P. B. Lynch and A. H. Jensen
Journal of Animal Science, V. 41, No. 5, p. 1512-1520, Nov., 1975. 1 fig, 7 tab., 34 ref.

Keywords: Swine houses, Air pollution, Bacteria, Dust.

Aerial levels of bacterial-colony-forming particles (BCFP) in lung-depositable size ranges were determined using an eight-stage Andersen viable sampler with tryptose agar. Aerial levels of BCFP ≤4.7 µm and ≤ 3.3 µm in aerodynamic diameter were significantly and positively correlated with toal-aerial-BCFP level in swine-house air. On average, 31 percent of aerial BCFP were ≤4.7 µm and 15 percent were ≤3.3 µm in four University enclosed swine houses (n = 192); 31 percent and 22 percent, respectively, in a University modified-open-front house (n = 44) and 28 percent and 11 percent, respectively, in 12 houses at five commercial operations' (n = 24). Aerial-dust level was determined using a Staplex high-volume sampler. Aerial-BCFP and dust levels were significantly and positively correlated. There tended to be fewer aerial BCFP per unit of aerial dust in the modified-open-front houses than in the enclosed houses at the University. Ten swine houses at commercial operations and four at the University were studied a total of 16 times to determine concentrations and sizes of aerial bacterial particles which formed colonies on tryptose (general medium), Chapman-Stone (special medium for staphylococci), KF Streptococcus (fecal streptococci) and MacConkey (coliforms) agars, respectively. Ratio of bacterial-colony-forming-particle (BCFP) count on Chapman-Stone agar to that on tryptose averaged .36, that on KF Streptococcus to that on tryptose averaged .13 and that on MacConkey to that on tryptose averaged less than .01. Twenty-one percent of the staphylococcal BCFP and streptococcal BCFP, respectively, and 9 percent of the coliform BCFP, were lung-depositable (≤4.7 µm in diameter). Nitrogen content of aerial dust in a swine-finishing house, in which a 13 percent crude-protein (CP) diet was fed, averaged 4.6 percent, or (4.6 x 6.25) Z = 28.7 percent CP (n = 17). Settled dust in a farrowing house, in which a 12 percent CP diet was used, averaged 23.3 percent CP (n = 6), whereas that in a room in which diets having 12 to 16 percent CP were prepared averaged 13.0 percent CP (n = 4). It was concluded that much of the dust in swine-house air was feed dust. (Copyright 1975 - Journal of Animal Science)

4163-A8, B2, B3, C2, E2
TRANSFORMATIONS OF NITROGEN ADDED AS AMMONIUM AND MANURE TO SOIL WITH A HIGH AMMONIUM-FIXING CAPACITY UNDER LABORATORY CONDITIONS

Soil Research Institute, Agriculture Canada, Ottawa, Ontario
F. J. Sowden
Canadian Journal of Soil Science, V. 56, No. 4, p. 319-331, Nov., 1976. 1 fig., 6 tab., 13 ref.

Keywords: Nitrogen transformations, Soils, Dairy manure, Liquid wastes, Solid wastes, Ammonium sulfate.

Ammonium sulfate, dairy cattle liquid manure and the ''liquid'' and ''solid'' fractions from the manure were separately added to 300-g samples of a loam soil at the rate of 250 μg N/g of soil and incubated in the laboratory at 22 C and 60 percent water-holding capacity. The Brunisolic soil sample used contained 20 percent clay which was largely vermiculite. Subsamples were removed at intervals for analysis of nitrate, exchangeable and fixed ammonium, Warburg studies of respiration rate and the distribution of organic N. One series of duplicate samples was leached with water three times during the course of the experiment which was over a year. About half of the nitrogen of the manure was in the NH_4^+ form and the exchangeable N from this as well as that from $(NH_4)_2SO_4$ rapidly nitrified (in about 3 wk) in both the leached and unleached series. About 40 percent of the NH_4^+-N of the manure and fertilizer was fixed by the clay and this was nitrified more slowly. With the fertilizer-NH_4^+ the fixed-N was reduced after about a year to a value slightly above that of the control soil at the beginning of the experiment. With the manure and its liquid fraction a smaller proportion of the ''added'' fixed NH_4^+ was nitrified. There was no increase in fixed-NH_4^+, nitrate or exchangeable NH_4^+ throughout the experiment with the solid fraction, although with the control soil more than 100 μg/g or nitrate was formed. There was a slight increase in amino compounds, amino acids and amino sugars, from 31 to 245 days. The amounts of these compounds were highest with the solid-fraction-treated soil and lowest with the control. The oxygen uptake was highest with solid-amended soil at all times; after about 180 days the soils treated with the other materials had the same oxygen uptake as the control soil. Leaching of the soil removed the nitrate formed but did not appear to have any other effect. Three leachings, the last after 245 days, removed 113 μg mineral-N/g soil from the control and only 144 μg/g from the manure-treated soil although 142 μg NH_4^+-N/g soil had been added to the latter. Clay fixation and immobilization had apparently ''tied up'' most of the added mineral-N. (Copyright 1976 - Canadian Journal of Soil Science)

4164-A1, B2, D3, E3
JAPANESE HOGMEN BATTLE POLLUTION

Information Division, Foreign Agricultural Service
W. Lindell
Missouri Ruralist, V. 118, No. 3, p. 96-99, Feb. 12, 1977.

Keywords: Japan, Swine, Pollution, Waste management, Oxidation ditch, Refeeding.

A two hectare farm is the site of a demonstration project for alleviating pollution in raising hogs in Japan. This project was mounted under a three way contract between the U.S. Feed Grains Council, the Tomioka City Agricultural Cooperative, and Masakoti Kurosowa, owner of the farm and member of the co-op. This facility was designed to handle 90 brood cows and produce about 1400 swine a year for market. The special attraction of the project is a pollution-free swine barn that is equipped with an oxidation ditch system that circulates wastes in solution below slatted floors in the finishing house, insuring no scraping labor, little odor and no liquid discharge. Another important aspect of this system is recycling, which hasn't been tested yet but trials are scheduled for the future. In this process, liquids will be pumped from the oxidation ditch into drinking basins in the finishing barn, where protein-but no energy-will be recovered by the hogs. This is important because feed costs are about double those in the U.S. and feed represents 70 percent of the cost of hog production. (Bates-East Central)

4165-B2, B3, E2, E3
RECYCLING IS SUCCESSFUL AT MERTEN'S

Anonymous
Calf News, V. 15, No. 2, p. 44, Feb., 1977.

Keywords: Feedlots, Waste management, Recycling, Refeeding, Irrigation, Liquid wastes, Solid wastes, Cattle.

A review is given of John Merten's successful 5800-head slatted floor confinement operation near Holtville, California. The feedlot, complete with manure recycling unit, was built by Corral Industries of Phoenix, Arizona, and aside from a few bugs with the pump and some other small troubles, the whole thing has been a success. The feedlot was built on a rise in the terrain so that liquid wastes could flow by gravity into the fields. The solid fraction of recycled waste is refed to Merten's growing stock. The Merten-type operation seems to be an excellent alternative in meeting EPA standards. (Albertson-East Central)

4166-A11, B1, C3
RECYCLING OF LITTER FOR TURKEY BROODING SAFE

Anonymous
Poultry Digest, V. 35, No. 417, p. 464, Nov., 1976.

Keywords: Litters, Turkeys, Recycling, Bacteria.

It appears to be safe to reuse litter for brooding turkeys. While new litter originally has less mesophilic bacteria, after 2 weeks the concentration of such bacteria is about the same in both new and recycled brooder house litter. A maximum of 1 million coliforms per gram of litter appears to be present in new or recycled litter after the first 2 weeks. It was found in this study that after 2 weeks of age, the air in the brooder house contained about 1000 airborne mesophilic bacteria per cubic foot of air, and 100 airborne mold and yeast per cubic foot of air. After 6 weeks of age, litter coliform and mold declined at similar rates. Since this data was collected, one firm has completed 3 cycles of brooding and growing on recycled litter with no increase in brooder or growing house mortality. Furthermore, feed efficiency and USDA grade yield remained unchanged for turkeys brooded and grown on recycled litter. (Albertson-East Central)

4167-B3
MINI LOADERS PROVIDE FAST MANURE REMOVAL

Anonymous
Missouri Ruralist, V. 118, No. 3, p. 69, Feb. 12, 1977.

Keywords: Manure removal, Equipment.

One of the quickest and most efficient machines for feedlot cleanout, as well as a variety of other chores around the farm, is the compact, four-wheel-drive, skid-steer loader. A wide range of attachments are often available to broaden the versatility of the loaders for industrial and on-the-farm uses such as forklifts, crane booms, manure forks, post-hole diggers, drawbars, counter-weights and bucket side cutters. A relatively wide range of loader sizes is available on the market. When selecting a skid-steer loader, consider accessibility of the engine and hydraulic system components requiring periodic service. (Albertson-East Central)

4168-A3, A4, A8, B2, B5, C2, E2
ORGANIC MANAGEMENT REDUCES LEACHING OF NITRATE

H. H. Koepf
Bio-Dynamics, No. 108, p. 20-30, Fall, 1973. 4 tab.

Keywords: Nitrates, Farm wastes, Soils, Leaching, Illinois, Investigations, Fertlizers, Silts, Loam, Runoff, Waste management, Organic management.

The reduction of nitrate leaching by the application of organic manuring fluids was investigated and compared with adjacent areas under orthodox commercial farming. The nitrate concentration in the tile drainage runoff was determined in four fields in Buffalo, Illinois, from 1969-1973. The average monthly nitrate concentration is tabulated when there was a runoff from the tiles. It is concluded that fertilizing with commercial nitrogen interferes with the changes which the nitrogen continuously undergoes in the soil. The drainage outlets in the soils under investigation are rather close to the surface. Although in these silt loams it might take several months before water from the surface arrives at the depth of these tiles, the tests showed that the biological soil processes are a crucial factor which determines nitrate leaching. The cycles of mobilization-immobilization, nitrate supply for the crops, etc., seem to be different in soils under organic management from those in soils treated chemically. (Merritt-FIRL)

4169-A8, B1, B5, C2, E2
HOW MUCH MANURE SHOULD WE PUT ON?

Anonymous
Hoard's Dairyman, V. 122, No. 7, p. 454, 484, April 10, 1977. 1 fig., 5 tab.

Keywords: Manure application, Nutrients, Fertilizers, Land application, Crop response, Forages, Nitrogen, Phosphate, Potash.

In spite of the many new uses proposed for animal manure, the bulk of it will continue to be returned to the land. Consequently, we must consider: (1) how much manure animals produce, (2) nutrient content of manure, and (3) how spreading manure affects the commercial fertilizer needed. Rough estimates of manure production in terms of daily pounds, annual tons, and percent water content (in that order) for beef cattle, dairy cattle, and hogs are: beef cattle-60, 11, and 80; daily cattle-70, 13, and 84; and hogs-9, 1.7, and 75. Nutrient content of manure may vary due to type of storage, length of storage, percent mosisture, and how manure is spread and incorporated into the soil. Average amounts (pounds per ton) of nitrogen, phosphate, and potash found in the manure of beef cattle, dairy cattle, and hogs are: (1) beef cattle: nitrogen-14, phosphate-9, potash-11, (2) dairy cattle: nitrogen-12, phosphate-5, potash-12, and (3) hogs: nitrogen-10, phosphate-7, and potash-13. In most cases commercial fertilizer will be needed in addition to manure to provide N-P-K in amounts required for profitable crop growth. When manure is used to provide part of these nutrients, a soil test and chemical analysis of the manure are suggested. These amounts must then be compared to the amount of nutrients removed by specific crops. The greatest response of forage crops to manure occurs when it is applied to grass sods, preferably during the winter or early spring. Tests have shown that too much manure can be applied to the land. Maximum rate depends on soil type, frequency of application, and crop to be grown. (Albertson-East Central)

4170-A4, A6, B2, C2, D1, D3, E2, E3

AUTOMATED TREATMENT AND RECYCLE OF SWINE FEEDLOT WASTEWATERS

Agricultural Engineering Department, The Ohio State University, 2073 Neil Avenue, Columbus, Ohio 43210
E. P. Taiganides and R. K. White
Environmental Protection Agency Report EPA-600/2-76-240, Sept., 1976, 137 p. 52 fig., 27 tab., 32 re.

Keywords: Swine wastes, Liquid wastes, Waste treatment, Recycling, Flushing, Wastewater reuse, Land disposal, Computer models, Water pollution, Odor.

A system for the automated flushing of hog wastes was designed and operated in conjunction with the biological treatment and recycling of the treated liquid effluents as flushing water. The treated solids were disposed of to farm fields. The system included tipping buckets, overhead siphon tanks, and flushing gutters with the waste receiving primary treatment with solids separation and aerobic stabilization of solids and secondary treatment in an oxidation ditch and final clarification before returning the liquid to the flushing system. Tertiary treatment utilizing high-pressure-driven membranes was evaluated. (Taiganides-Ohio State University)

4171-A7, B2, C2, D1

MANURE PITS CONTAIN GASES THAT CAN KILL

Anonymous
Wallaces Farmer, V. 102, No. 7, p. 42, April 9, 1977.

Keywords: Gases, Toxicity, Hydrogen sulfide, Ammonia, Carbon dioxide, Methane, Ventilation, Agitation.

The lack of oxygen in manure pits causes toxic gases that can kill. Hydrogen sulfide, ammonia, carbon dioxide, and methane may all be formed. Of these, hydrogen sulfide is the most toxic. All gases present in manure pits with the absence of oxygen affect the respiratory system, eventually causing breathing paralysis and death. Ventilation of manure pits can help avoid such problems. Air should be pulled from the building down through the pits and exhausted outside. A plastic curtain placed over the slotted floor will duct the noxious gases out of the building. Rules for working around a manure pit include: (1) Enter a manure pit only if it is absolutely necessary. (2) When entering, have an auxiliary air supply and a rope around your body managed by two strong persons. (3) Agitate manure tanks when buildings can be opened wide and well ventilated. (4) Stay away from building while agitating and remove animals if possible. (5) Agitate during warm weather so that the animals can be removed. (Albertson-East Central)

4172-A8, B2, B3, C2, D1, E2, F1

LAND DISPOSAL OF BLOOD AND PAUNCH MANURE

Department of Agricultural Engineering, Texas A&M University, College Station, Texas 77843
D. L. Reddell, K. R. Brown, and J. M. Sweeten
Proceedings of Management of Slaughterhouse and Meat Processing Wastes Seminar, Waco, Texas, July 29, 1976, p. III-71-III-98. 5 fig., 8 tab., 9 ref.

Keywords: Land disposal, Blood, Paunch manure, Packing plant wastes, Nitrogen, Soil injection, Dehydration, Energy, Costs.

Disposal or utilization of blood and paunch manure is one of the most perplexing problems around meat packing plants. Both have an extremely high pollutional strength. Paunch material is generally regarded as having low value with very limited demand. Blood, however, has a high nutritive value, but is not produced in marketable quantities at most of Texas' 352 state inspected meat packing facilities. Land application of blood and paunch manure is an environmentally acceptable means of disposal of such wastes at small at medium-sized packing plants. The limiting factor for disposing of blood is nitrogen, while paunch disposal is governed mainly by the volumetric (hydraulic) loading rate. Slurry mixtures of blood and paunch may be advantageous because they can be applied to soils using conventional liquid manure handling equipment, after dilution to 4 to 6 percent solids. Soil injection is recommended as a means of controlling odors, flies, surface runoff, and nutrient loss. (Albertson-East Central)

4173-A6, A10, B3, C2, D1, E3, F1, F2

A POLLUTION SOLUTION WITH BUILT-IN PROFITS

Anonymous
Egg Industry, V. 4, No. 6, p. 27-36, 43-44, 48, June, 1971. 10 fig.

Keywords: Dried poultry wastes, Recycling, Fertilizers, Soil amendments, Refeeding, Nutrients, Equipment, Costs, Food and Drug Administration, Legal aspects.

Drying manure in commercial driers reduces odor, while at the same time creating a marketable product. The drying must be done quickly with extremely high temperatures that pasteurize the product, reduce volume of original manure down to one-third and eliminate all odors and emissions. The dried poultry wastes (DPW) emerge from the drier in a low moisture form which can be bagged or stored in bulk without danger of losing its mineral contents. A Michigan State University analysis revealed DPW (which may vary in content) to be 5.24 percent nitrogen, 3.28 percent phosphoric acid, and 2.54 percent potash K_2O. The experiences of several producers in drying and selling their wastes as fertilizers and soil amendments are cited. Dried poultry wastes (also known as "DPW", "toasted protein", "recycled nutrients", and "Bio-X") are also being used as a feed ingredient for poultry and livestock. But the Food and Drug Administration has not set up guidelines for general use of the product. Lack of information is the biggest problem. Several things must be determined before the feeding of such wastes will be sanctioned. These include: (1) a full description of processing methods and analytical controls, (2) degree of uniformity of the product, (3) status of pathogenic organisms in the product to be fed, (4) levels of pesticides, drugs, heavy metals or other substances must be shown safe for animal consumption, (5 no harmful residues from drugs, pesticides or other substances should occur in the edible tissues or by-products of animals consuming the product to be fed. Advantages of using commercial driers are: (1) elimination of fly breeding, (2) elimintaion of odor, and (3) provision of a completely enclosed system for moving manure to the drier and the pasteurized product to the feed mill. Descriptions and costs of several different driers are given. (Albertson-East Central)

4174-B2, B4

OPEN COMPOUNDS FOR SHORT TERM MANURE STORAGE

H. L. Brodie
Cow Moos, p. 3-4, Jan., 1974. 4 fig.

Keywords: Waste storage, Costs, Design, Cattle wastes.

During periods where the time or a location for manure spreading is unavailable, some type of storage is necessary. The manure storage system should require a small capital investment without producing a significant increase in operating cost. All drainage from a storage system should be captured in a lagoon, or carried by a grassed diversion or waterway to a grassed area for seepage into the soil. Four storage systems are presented. The least expensive storage structure would have earth berm walls with a concrete base and a wooden fence wall to allow for water drainage. The second system is of the same type but with wood post and plank walls not more than four feet high. The third system is a concrete feedlot above grade. Manure can then be pushed off the edge into the storage compound that has a frontal sloped floor. The last sytem is similar to system 3 but includes a manure ramp for spreader loading. The concrete basin is constructed with low side walls for equipment entrance and exit. The storage period for all these systems should not exceed 2 months. Design areas of about 3/4 square foot per cow per day can be used for storage requirements. For further information or design assistance contact your local country extension office. (Bates-East Central)

4175-A6, B2, C2, D3, E3

METHANE GENERATION FROM LIVESTOCK WASTE

Agricultural Engineering Department, Purdue University, Lafayette, Indiana 47907
D. D. Jones and A. C. Dale
Department of Agricultural Engineering Mimeo, Purdue University, Lafayette, Indiana, 1974, 14 p. 3 fig., 5 ref.

Keywords: Anaerobic digestion, Methane, Gases, Safety, Nitrogen, Anaerobic digesters, Storage, Odor.

Methane generation is accomplished by anaerobic digestion of organic substances such as livestock wastes and plant refuse. The biological conversion of organic waste to methane requires 2 groups of bacteria. The first group, ''acid formers'', converts waste to organic acids to methane and carbon dioxide. Optimum conditions for digester operation are uniform loading, neutral acidity, 95 temperature, balanced carbon to nitrogen ratio of 30:1, and levels of harmful substances which are below their toxic concentration. Suggestions for building a methane digester and collecting and storing the gas are given. In general, gas produced should have little or no odor since methane and carbon dioxide are odorless. Safety equipment and special tanks must be used and venting is very important. Once the process has started and reached a steady state, upsets should not be too common if C:N ratio remains about the same and digester temperature is maintained. The primary limitation on loading of livestock waste is its high nitrogen content. Crop residues and leaves have low nitrogen content. By mixing crop residues with livestock wastes, the ammonia toxicity problem can be reduced, the loading rate can be increased, and the gas production should increase accordingly. Advantages of an anaerobic digester are: (1) generation of very little odor, (2) only a slight reduction of fertilizer value of the wastes, (3) low expenditure of energy, and (4) production of a useful product -- gas. Disadvantages are: (1) expense, (2) increase in wastes to be disposed of due to dilution water, (3) the high level of management required, (4) safety -- methane is very explosive when mixed with air, and (5) storage difficulties. (Albertson-East Central)

4176-A6, A7, B1, D2

PRODUCTION AND TRANSPORT OF GASEOUS NH_3AND H_2S ASSOCIATED WITH LIVESTOCK PRODUCTION

Agricultural Engineering Department, Oregon State University, Corvallis, Oregon 97331
J. R. Miner
Environmental Protection Agency Report EPA - 600/2-76-239, Sept., 1976, p. 69. 7 fig., 26 tab., 59 ref.

Keywords: Odor, Air pollution, Water pollution, Ammonia, Hydrogen sulfide, Masking agents, Mint oil, Cattle, Swine, Ration effects, Gas sampling, Feces, Urine.

Current livestock production techniques release a large variety of volatile organic compounds to the atmosphere. This release results in complaints due to their odorous nature and has been identified as a source of surface water pollution as these compounds are absorbed from the air. Ammonia has been identified as the compound of greatest concern relative to water pollution and is of considerable interest relative to odor complaints due to its ease of measurement and its relationship to more odorous gas evolution. Gas sampling and measuring schemes based upon the use of solid absorbents were studied. Use of an absorbent suspended in a stainless steel screen container which could be exposed in an atmosphere to be sampled showed promise. The evolution of ammonia, hydrogen sulfide and odorous volatiles was investigated as a function of beef cattle ration. Addition of essential oil, mint oil, was found to mask the odor of fresh manure. Mint oil was carried in the urine. Ammonia evolution from fresh manure was largely from urine. Fecal contributions became significant only after significant decomposition had occurred. A technique was devised for measuring ammonia evolution rates from surfaces. This measurement proved an accurant measure of anaerobic biological activity and provided a quantitative means for comparing treatment procedures designed to minimize volatile material evolution rates. Evolution rates for a variety of surfaces associated with livestock production enterprises were measured. (Miner - Oregon State University)

4177-B2, C2, D3, E3, F1

METHANE PRODUCTION THROUGH BIOCONVERSION OF AGRICULTURAL RESIDUES

Department of Agricultural Engineering, University of Manitoba, Winnipeg
D. D. Schulte, E. J. Kroeker, A. B. Sparling and H. M. Lapp
Presented at the International Solar Energy Society Meeting, Winnipeg, Manitoba, August 11-15, 1976, 11 p. 4 tab., 26 ref.

Keywords: Animal wastes, Crop residues, Bioconversion, Anaerobic digestion, Design, Economic feasibility, Biological process - stability, Gas handling.

Bioconversion of agricultural residues to methane gas has been restricted in the past by lack of understanding of process performance at the high organic loading rates and high organic solids concentrations normally associated with animal manures and crop residues. Experiments at the University of Manitoba carried out at organic loading rates several times that normally associated with sewage sludge digestion and at ammonia concentrations far above that formerly thought to be toxic to methane producing bacteria have shown extreme process stability. These and other results indicate that there may be a useful role for anaerobic digestion in the formulation of practical and economic farm-scale bioconversion units. (Schulte - University of Manitoba)

4178-B2, C2, D3

ANAEROBIC DIGESTION STABILITY AND FOOD-PROCESSING WASTE TREATMENT

Department of Agricultural Engineering, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada
E. J. Kroeker, D. D. Schulte, H. M. Lapp, and A. B. Sparling
Presented at the First International Congress on Engineering and Food, Boston, Massachusetts, Aug. 9-13, 1976, 22 p. 2 fig., 3 tab., 21 ref.

Keywords: Anaerobic digestion, Swine wastes, Food-processing wastes, Ammonia, Toxicity, Process stability, Feasibility, Slurries.

Pilot-plant and laboratory studies on the anaerobic digestion process have provided the following conclusions regarding process stability: (1) Extreme process stability was achieved during pilot-plant digestion of swine manure despite the occurrence of process phenomena usually thought to cause process failure; (2) An important role is played by the initial acclimation of the fastidious methanogenic bacteria to changes in the type of organic substrate; (3) Laboratory digestion of an urea-laden acetic-acid substrate at pH and alkalinity conditions characteristic of swine-manure digestion indicated that although progressive inhibition occurred as the ammonia concentration was increased beyond 2000 mg/1 as N, toxicity never occurred even at ammonia concentrations as high as 7000 mg/1 as N; (4) Process inhibition by ammonia appeared to be due to excessive concentrations of free ammonia rather than ammonium ion; (5) Process toxicity was caused by UVA in a concentration range of 30 to 60 mg/1 as acetic acid; (6) The mechanisms of process stability in anaerobic treatment of nutrient-rich organic wastes such as livestock manure and meat, fish and poultry-processing waste slurries are biochemically associated with the relatively high concentrations of ammonia in solution; and (7) Feasibility of anaerobic digestion of food-processing waste slurries is dependent upon maintenance of adequate mixed-liquor pH and buffering capacity. (Merryman-East Central)

4179-A9, A10, B1, D2, D3, F1

FLY CONTROL THAT COSTS ALMOST NOTHING

Cooperative Extension Service, 36 Harvard St., Worcester, Massachusetts 01608
Ruggles, L. H.
Poultry Digest, V. 36, No. 423, p. 236-237, May, 1977. 3 fig.

Keywords: Biological fly control, Larvicides, Costs, *Carcinops pumilio*, *Marcrocheles muscaedomesticae*, Poultry manure.

After enormous insecticide costs ($2800 from the summer of 1974 through the fall of 1975), Massachusetts poultryman Louis Ruggles was still unable to control house flies. Consequently, he decided to try a biological fly control system using the histerid beetle, *Carcinops pumilio* and the manure mite, *Macrocheles muscaedomesticae*, which kill flies by feeding on them in the egg and larval stages. Poultry cage manure was seeded with the predators. There was a temporary setback due to having to spray a larvicide to kill an outbreak of cereal mites, but finally the predators were established. The fly population was so reduced that no pesticide treatment was needed in the cage house during the entire fly season. When cleaning the cage house, some manure containing the beneficial beetles and mites was left behind and scattered under the cages. Although the house fly population was controlled by the predators, the humpbacked fly, *Megaselia aletiae*, and the darling beetle, *Eleodes* sp, were not found to be controlled by the predators. It is hoped that agents specific to their control will be identified. Altogether, 17 cage farms in Massachusetts have been seeded with a fly predator population. Other farms remain to be seeded, but unexpected problems in flock health risks have slowed the process. Plans are under way to establish some colonies of predators to use as seeding material so that transfer of manure and its accompanying risks become unecessary. Real savings in pesticides, equipment and labor costs resulted from the use of the predators. The predators have not been found to cause any harmful effects to man, poultry, or building materials. (Bates - East Central)

4180-E3, F2
SEPEA ANNOUNCES POULTRY WASTE FEEDING POSITION

Anonymous
Feedstuffs, V. 49, No. 20, p. 23, May 16, 1977.

Keywords: Refeeding, Food and Drug Administration, Southeastern Poultry and Egg Association, Recycling, Regulations.

Upon hearing that the Food & Drug Administration (FDA) is expected to issue a notice this spring inviting comments for the consideration of the FDA in making further decisions with regard to recycling poultry wastes, the Southeastern Poultry and Egg Association (SEPEA) stated that it felt that regulations relating to the recycling of poultry wastes should be left mainly to individual states. SEPEA pointed out that some of the regulations adopted by the states have been approved by the Association of American Feed Control Officials. SEPEA plans to file a comment with the FDA at the appropriate time and let its feelings be known. (Rowe-East Central)

4181-E3, F1
USDA RESEARCHER USES MANURE TO MAKE FEED AND WALLBOARD

Anonymous
Beef, V. 9, p. 5, Oct., 1972.

Keywords: Recycling, Agricultural Research Service, Wallboard, Feeds, Refeeding, Feed additives, Fungus.

A two-step process has been developed by the Agricultural Research Service which may offer a partial solution to the growing problem of feedlot wastes. During a fractionation process, these three products are obtained: (1) A feed fraction that compares with soybean meal in protein content. Amino acid balance comprises 43 percent of the waste. (2) A residue fraction (50 percent of the waste) which contains fibrous material which can be treated with resin and then pressed into board. This board doesn't have the strength or water resistance of commercial hardboard, but it is believed that the addition of other waste fiber and oils may overcome this deficiency. ARS researchers have also used the residue as a nutrient for a fungus which produces a fiber-digesting enzyme which can be used to treat chicken feed to improve digestibility. (3) A soluble fraction (7 percent of the waste) which was recombined with the fiber in some fungus-growing experiments. ARS scientists estimated that the feed fraction was worth $20 per ton over the cost of recovery. (Rowe-East Central)

4182-A3, A4, B1, B5, F1
RESOURCE ADEQUACY IN LIMITING NONPOINT POLLUTION

Agricultural Economist, Iowa State University, Ames, Iowa
E. O. Heady
Paper No. 76-2562, American Society of Agricultural Engineers, Chicago, Illinois, December 14-17, 1976. 15 p. 3 fig., 6 tab., 2 ref.

Keywords: Nonpoint pollution, Water pollution, Erosion, Agricultural runoff, Sedimentation, Model studies, Economics, Management.

The potentials of control of nonpoint pollution from agriculture by reduction of soil erosion and runoff are examined on the basis of a national programming model of 105 regions, 41 water supply regions and 9 land groups per region. The economics of management alternatives are evaluated. The alternatives were identified as: (1) Base Alternative--This alternative represented a single projection of ongoing variables to the year 2000. all other alternatives were based on modifications of the Base Alternative. (2) High Export Alternative--All conditions and constraints of the Base Alternative were retained except that higher levels of exports were used. (3) Land and Water Conservation Alternative--All conditions of the Base Alternative were retained except that the solution was constrained to cropping patterns and conservation practices that would achieve sustained long-run productivity. (4) Environmental Enhancement Alternative--In addition to retaining the soil loss conditions of the Base Alternative, 3 environmental conditions were included: (a) no further development of wet soils for cultivation was allowed beyond 1975, (b) the water supply available for agriculture was reduced to allow minimum stream flows for maintenance of water quality and protection of aquatic life and (c) livestock wastes could not accumulate at production sites but had to be returned to the land. A discussion is given of the effect of each of the alternatives on soil loss levels, conservation and tillage practices used, and resource and commodity prices. (Albertson - East Central)

4183-B2, B3, B5, C2, E2
MANURE IMPORTANT FACTOR IN 338 BUSHEL RECORD CORN YIELD

Beef Editor
R. Watkins
Beef. V. 13, No. 5, p. A-26-A-27, Jan., 1977. 2 fig.

Keywords: Swine wastes, Cattle manure, Crop production, Corn, Yields, Nitrogen, Organic wastes.

Herman Warsaw of Saybrook, Illinois, produced the world's record corn yield of 338 bushels an acre in 1975. He attributed manure to be a major factor in achieving top crop yields. Warsaw spread his hog finishing lot up to 2 feet deep with corn cobs. These corn cobs soaked up solid and liquid wastes from his fall finishing pigs. The manure-saturated cobs were then left until the following fall to be picked up and spread. Practically all the manure was retained on the cobs. By the time the manure/cobs mixture was spread on the corn fields, the cobs had broken up into a mixture that looked almost like dirt. 1975 was the third year in a row of manure/cobs application to the record-yield plot. It was the 15th year to be planted in corn. The field was chisel-plowed as part of a total-farm conservation tillage program. The hybrid variety for Warsaw's record corn yield, purchased from FS Services, was FS 854, a 115-day single cross with moderate upright leaves and two-ear tendency. Four hundred pounds of chemical nitrogen was applied along with the manure. Warsaw felt that the manure-saturated cobs probably added another 39 pounds of nitrogen. Cattle manure from Warsaw's feedlot is also being applied to cropland, particularly on spots where the soil is then. Increasing yields over the years show that cattle manure definitely helps. (Albertson-East Central)

4184-B1, C2, E3
FEED GRAIN SUPPLIES, USE OF WASTES AS FEED INGREDIENTS DETAILED AT CONFERENCE

Anonymous
Feedstuffs, V. 48, No. 43, p. 5, 66, Oct. 18, 1976.

Keywords: Feeds, Recycling, Poultry wastes, Cattle wastes, Grains, Crop residues, Cannery wastes, Packinghouse wastes, Nutrients.

Based on U.S. Department of Agriculture statistics and projections, world feed grain supplies for 1976-77 are expected to increase by about 7 percent or 83 million tons above this year's levels. U.S. feed grain production is estimated to be around 190 million tons, or 5 percent above a year ago. Trade sources feel there may well be an increase in alfalfa plantings this year, depending on the producer's attitude toward his substitute crops--mainly cotton, grain and tomatoes. Hay prices may be somewhat lower next year. It appears that poultry and cattle wastes can be recycled as animal feed more economically than they can be disposed of or used as fertilizer. In feeding of poultry litter, a 150-day trial showed in a cost analysis that cost per pound of grain ranged from 51.85 cents for the ration containing 15 percent poultry litter and no alfalfa to 55.61 cents per pound for the rations containing 15 percent alfalfa and no litter. Residues of corn, milo, small grains and sugar beets can be an economical source of feed in many beef operations if properly supplemented. Rations based on forage crop residues may be deficient in protein energy, minerals and vitamins. To assure accurate supplementation, a chemical analysis should be made because nutrient composition of these residues will vary with variety, growing conditions and harvesting methods. To permit extensive use of straw in animal feeds, some form of processing is needed to improve digestibility. A lot of digestible nutrients are disposed of when California canners and packers dispose of the nearly 1 million tons of vegetable and 200,000 tons of fruit waste generated each year. Even after accounting for the high moisture percentage of these products. totals represent substantial amounts of nutrients, including: cull fruit represents the total digestible nutrients produced by 14,000 acres of irrigated barley, and vegetable waste represent the crude protein produced by 21,000 acres of high-yielding alfalfa. (Rowe-East Central)

4185-A11, C2, E3
REFEEDING OF AERATED POULTRY WASTES TO LAYING HENS

Department of Agricultural Engineering, College of Agriculture and Life Science, Cornell University, Ithaca, New York 14853
J. H. Martin, Jr., D. F. Sherman, and R. C.

Loehr.
Paper No. 76-4513, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 11 p. 3 fig., 4 tab., 12 ref.

Keywords: Refeeding, Poultry wastes, Laying hens, Performance, Proteins, Phosphorus.

Refeeding of animal wastes is an attractive concept because it offers the potential of more efficient utilization of nutrients contained in conventional feedstuffs by secondary extraction. Successful utilizaton depends upon ability to incorporate the waste into a balanced ration at a cost below that of conventional ingredients. From a nutritional standpoint, the most desirable target species for refeeding of manure from a monogastric animal such as the chicken is a ruminant. However, the refeeding of poultry waste is not usually accomplished due to logistical problems. The alternative is direct refeeding to laying hens. One hundred and eight laying hens were refed aerated poultry wastes in place of tapwater over an 8 month period. Comparison of performance with a control group indicated no adverse effects on bird performance. Hence, a real potential exists to recover nutrients from this material. Two areas of particular interest are true protein and phosphorus. However, additional information concerning aeration system operation to enhance microbial protein synthesis as well as the availability of phosphorus to the hen is necessary before the true potential of this practice can be fully determined. (Albertson-East Central)

4186-A2, B2, C1, C2, D1, D3, E1, F1

A LOW COST SETTLING BASIN AND INFILTRATION CHANNEL FOR CONTROLLING RUNOFF FROM AN OPEN SWINE FEEDLOT

Animal Sciences Department, Purdue University, West Lafayette, Indiana 47907
A. L. Sutton, D. D. Jones and M. C. Brumm
Paper No. 76-4516, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 16 p. 4 fig., 4 tab., 10 ref.

Keywords: Waste treatment, Waste disposal, Swine wastes, Feedlots, Agricultural runoff, Labor Costs, Settling basin, Infiltration channel, Physical properties, Chemical properties.

The objectives of this case study were: (1) to evaluate the performance of a low-cost settling basin and infiltration channel for treating and disposing of swine feedlot runoff and (2) to determine management and labor requirements and costs of the open feedlot and runoff control system. The settling basin and grassed infiltration channel were constructed next to a 300-head open shed and outside swine feedlot to dispose of lot runoff. The settling basin reduced total solids by 68 percent and N, P and K from 55 to 60 percent in the runoff, while remaining nutrients were absorbed by the soil. The investment cost for construction of the Cargill feedlot and runoff control system was $43 per head capacity. The runoff control system, including settling basin, infiltration channel and small earthen detention structure, was $3 per head capacity, which is about 7 percent of the total cost of the unit. It took 2 men 1½-3 hours each month and a total of 36 to 72 man hours per year to clean the lots and haul the manure to the field. Total amount of manure removed from the feedlot was 7605 bushel/year. Labor for the infiltration channel was negligible, other than clipping grass in the channel area. This case study will be continued to further evaluate the performance of the settling basin and infiltration runoff control system. Additional rainfall, runoff composition, soils and soil solution data, as well as management information, will be collected. (Albertson - East Central)

4187-A11, B1, C2, E3

FEEDING VALUE OF EXCRETA-STOVER SILAGE AND CORN RESIDUE SILAGE FOR BEEF COWS

Agriculture and Home Economics Experiment Station, Cooperative Extension Service, Ames, Iowa
R. L. Vetter, W. Burroughs, T. Ritter, and A. Nipper
A. S. Leaflet R 217, Cooperative Extension Service, Iowa State University, July, 1975, 5 p. 4 tab.

Keywords: Refeeding, Performance, Cattle, Excreta-stover silage, Corn residue silage, Rations, Nitrogen.

Two refeeding trials were conducted to determine the feeding value of excreta-stover and corn residue silages for beef cows. Beef cows consumed up to 30 pounds of excreta-stover dry matter per day with weight gains of 2 pounds per day, indicating a silage of high palatability and good nutritional quality. Corn residue silage fed with a balanced protein and mineral-vitamin supplement supported above maintenance performance in beef cows. Compared with control rations, estimates of TDN were 53 percent for corn residue silage and 58 percent or possibly higher for the excreta-stover silage. (Vetter - Iowa State University)

4188-B2, B3, E2, F1

ECONOMICS OF DAIRY WASTE DISPOSAL SYSTEM FOR ALABAMA

J. L. Stallings, T. A. McCaskey, G. H. Rollins, and J. A. Little
Highlights of Agricultural Research, V. 20, No. 4, p. 3, Winter, 1973. 2 fig., 1 tab.

Keywords: Liquid wastes, Solid wastes, Flushing, Irrigation, Lagoons, Land spreading, Costs, Cattle, Confinement pens.

Four systems for dairy waste disposal were studied -- (1) the "conventional" system (scraping and hauling), (2) a flush-irrigation system, (3) semi-liquid haul system using a holding tank and a tank spreader, and (4) a two-stage, flush lagoon system. Systems 1 and 2 were complete confinement systems requiring removal of all the waste while 3 and 4 were partial confinement systems and required provisions for waste disposal only during milkings. Initial costs for systems 1-4 were: $6,318, $15,482, $7,662, and $5,879, respectively. The conventional system was cheaper per cow of the 2 confinement systems for herd sizes up to 240 cows. The flush-irrigation system became cheaper as herd size increased beyond 240 cows. All equipment for the conventional system was used only for the dairy enterprise and all costs were charged to it. As this might not actually be the case in a real-life situation, this fact must be held in mind when considering costs. The flush-lagoon system was the cheaper of the partial confinement systems up to its capacity of about 240 cows. However, both partial confinement systems were cheaper than the 2 complete confinement systems for this size operation. (Albertson - East Central)

4189-A5, A8, C2, E2

NITRATE LEACHING FROM ANIMAL WASTE APPLICATIONS

J. A. Lindley
M. S. Thesis, Purdue University, Dec. 1972, 129 p. 12 fig., 32 tab., 68 ref.

Keywords: Laboratory studies, Soil columns, Groundwater pollution, Leaching, Nitrates, Nitrogen, Dairy wastes, Land application, Application rates, Soils, Dilution.

Laboratory investigation was performed in which some of the potential management variables which might allow increases in rate of waste application were studied. Dairy cattle waste was applied to four foot soil columns in the laboratory and the leachate was analyzed to determine nitrogen changes. The rates of nitrate application were 24.6 and 3.2 lb. per acre-day; this gave an equivalent of 1700 and 220 pounds over the ten week experimental period. Sodium nitrate was added to give the high rate. The prepared solutions had 450 and 60 mg/1 NO -N, respectively. The effects on denitrification of 3 different levels of available energy were evaluated. These levels were provided by adding varying amounts of untreated waste in preparing the feed solutions. The prepared solutions were poured on top of the soil at the rate of 0.245 inches per day. An additional 0.49 inches per day of deionized water was applied to some of the columns to give 2 different soil moisture conditions. Two different soil types in conjunction with the above factors gave 24 experimental treatment combinations. Fifteen soil columns were used. It was concluded that: (1) Danger of nitrate pollution of groundwater can be minimized by proper management of waste applications. (2) Based on nitrate leaching through the soil, waste containing as much as 24.6 pounds of nitrate per acre-day may be applied to the land. (3) When conditions are not conducive to denitrification, applied nitrate leaches through the soil or is retained in the soil profile. (4) The amount of nitrogen lost increased with increasing available energy (C:N) ratio. (5) A stabilized waste does not contain sufficient available carbon to support denitrification. (6) There is no significant difference in nitrate concentration in leachates from silt loam or sandy loam soils. (7) Amount of nitrate retained is affected by soil type. (8) The amount (and percent) of nitrate denitrified is greater under a high rate of nitrate applications, when C:N ratio is held constant. (9) Increasing the amount of water applied with a nitrified waste significantly decreases the nitrate retention. (10) Nitrate concentration in leachate is decreased by adding water; this reduction is greater than the dilution factor. (Albertson-East Central)

4190-A5, A8, B5, C2, E2

NITROGEN INPUTS TO GROUNDWATER FROM LIVESTOCK WASTES

Department of Soil Science, University of Guelph, Guelph, Ontario, Canada
L. R. Webber
International Symposium Identification and

Measurement of Environmental Pollution, p. 110-114, 1971. 1 fig., 5 tab., 12 ref.

Keywords: Groundwater pollution, Nitrogen, Livestock wastes, Land application, Barnyard leachates, Ammonia, Nitrification, Denitrification.

The fate of land-applied nitrogen from livestock and poultry manures is of primary concern to farmers if the quality of the crop, soil, and water are to remain unimpaired. Significant portions of the nitrogen in the manures are hydrolysed and oxidized to nitrates which may be utilized in crop production, lost in leachates, denitrified to the gaseous forms, or immobilized in cells of microorganisms or soil organic matter. The characterization of groundwater flowing under a small unpaved barnyard showed that over 90 per cent of the inorganic nitrogen was in the nitrate form. Concentrations of nitrate-nitrogen in excess of 10 mg/1 were found in the groundwater as it flowed away from the yard but attenuation to acceptable levels occurred within 180 m of the yard. The application of 996 kg/ha of nitrogen from manures over a two-year period contributed more than 390 kg/ha of nitrogen to the groundwater during the second year. During the third year, with no additional nitrogen, it was shown that the previously added manure contributed 80 kg/ha with an average concentration of 24 mg/1. Non-manured lysimeters discharged nitrates at concentrations in excess of 10 mg/1 during the three-year trial. The data indicate that: (1) a yearly application of 450 kg/ha of nitrogen all from manure was an excessive rate in terms of groundwater quality, and (2) the disposal of manure should be limited to the season when a crop is actively growing. (Webber - University of Guelph)

4191-C2

LOSSES FROM CATTLE FAECES DURING CHEMICAL ANALYSIS

Animal Industry and Agriculture Branch, Department of the Northern Territory, Darwin, N.T.
L. Falvey and A. Woolley
Australian Journal of Experimental Agriculture and Animal Husbandry, V. 14, No. 71, p. 716-719, 1974. 2 tab., 9 ref.

Keywords: Sampling, Chemical analysis, Cattle manure, Nitrogen, Temperature, Drying time, H_2SO_4-H_2O_2method, micro-Kjeldahl method.

The effects of drying temperature and method of sample digestion on the determination of nitrogen and dry matter in the faeces of cattle grazing pastures of two different nitrogen contents were examined. Nitrogen loss varied from 8 to 20 percent depending on the temperatures and associated length of drying time. The variation in the loss between samples from animals grazing the two pastures was small, tending to be higher for the samples taken from animals grazing a higher nitrogen pasture. Sample digestion by the H_2SO_4-H_2O_2 method was found to be as satisfactory as the micro-Kjeldahl method. Drying at 100° C for 24 hours gave the least loss of nitrogen. This procedure in conjunction with the H_2SO_4- H_2O_2digestion is proposed as a routine method for determination of nitrogen in faecal material. (Falvey - Department of the Northern Territory, Darwin, N.T.)

4192-A11, A12, C3

STAPHYLOCOCCI FROM THE FECES OF DIFFERENT ANIMAL SPECIES: BIOTYPES OF *STAPHYLOCOCCUS AUREUS* STRAINS OF SHEEP AND GOAT ORIGIN

Department of Microbiology, Faculty of Medicine, National University of Athens, Athens, Greece
G. Dimitracopoulos, C. Sakellariou, and J. Papavassiliou
Applied and Environmental Microbiology, V. 32, No. 1, p. 53-55, 1976. 1 tab., 16 ref.

Keywords: Sheep wastes, Goat wastes, *Staphylococcus aureus*, Rectal swabs.

Staphylococcus aureus was found in 96 percent of the rectal swabs from 133 sheep and in 80 percent of the swabs from 125 goats. Seventy-seven percent of the isolates from both hosts exhibited the fibrinolytic and growth characteristics of human biotype A on human plasma and crystal violet agar, respectively, but 99 percent of these isolates resembled *S. aureus* of animal origin in their other properties. Only 21 percent of the sheep and 24 percent of the goat isolates were clearly identifiable as human biotype A and animal biotypes B and C. (Dimitracopoulos - National University of Athens)

4193-A8, B2, E2

THE EFFECT OF PIG SLURRY APPLIED TO A SOIL SURFACE ON THE COMPOSITION OF THE SOIL ATMOSPHERE

Department of Agriculture, Freshwater Biological Investigation Unit, Greenmount Road, Muckamore, Antrim, Northern Ireland
E. J. Stevens and J. S. Cornforth
Journal of the Science of Food and Agriculture, V. 25, No. 10, p. 1236-1272, Oct., 1974. 4 fig., 1 tab.

Keywords: Swine, Slurries, Land application, Soil systems, Soil sealing, Ethylene, Gases, Soil atmosphere, Soil columns, Methane, Nitrous oxide, Hydrogen.

Intensive livestock production requires the storage and subsequent disposal of large volumes of slurry on land. The effect of the application of pig slurry to a soil surface on the composition of the soil atmosphere was investigated using laboratory soil columns. Slurry application stimulates soil microbial activity; however, the fine solids fraction of slurry or any treatment containing the fine solids was capable of blocking soil pores to gaseous diffusion. In agricultural practice slurry may at least temporarily cause anaerobic zones in soils which would otherwise be aerobic. Ethylene may be produced in these anaerobic zones, and diffuse throughout the soil and harmfully affect root growth. Soil drainage, varying climatic conditions and lateral gaseous diffusion will prevent extensive anaerobic zone formation in surface-sealed soils. Dry soils will recover more rapidly than wet soils. (Solid Waste Information Retrieval System)

4194-A11, E3

RECYCLING SEWAGE SOLIDS AS FEEDSTUFFS FOR LIVESTOCK

Department of Animal and Range Sciences, New Mexico State University, Las Cruces, New Mexico 88003
G S. Smith, H. E. Kiesling, J. M. Cadle, C. Staples, L. B. Bruce and H. D. Sivinski
Report of Research conducted under contract #E(29-2)-3626, U.S. Energy Research and Development Administration, Albuquerque Operations Office, in cooperation with Sandia Laboratories, 1976, 34 p. 16 tab., 22 ref.

Keywords: Recycling, Sewage solids, Refeeding, Sheep, Performance, Nutrients, Heavy metals, Trace minerals.

In an ongoing, cooperative research program, sewage solids from Albuquerque, New Mexico are being processed by thermoradiation treatment for destruction of pathogens at Sandia Laboratories and evaluated in animal experiments at New Mexico State University to assess nutritive value as feed supplements for cattle and sheep. Attention is being given to potential hazards of chemical toxicants in sewage as indicated by assays with rats and measurements of absorption and retention of heavy metals, trace elements and certain compounds by rats, sheep and cattle fed sewage products. Data from several experiments with sheep indicate that solids from undigested sewage provide considerable amounts of nutrients that are usable by ruminant animals. No symptoms of disease, toxicity or abnormality have been observed to date as a result of feeding sewage products to rats or ruminants; although tissue uptake of certain heavy metals and trace minerals has been measurably increased. Results obtained to date are recognized as tentative. The data reported herein were selected to typify the research program and illustrate the trends observed, rather than to provide a comprehensive report. (Smith-New Mexico State University)

4195-A11, B2, C2, E2, F1

MISSOURIANS VIEW IDEAS ON GUTTER, LAGOON, AND FREE-STALLS

H. Ernst
Missouri Ruralist, V. 118, No. 7, p. 20-21, April 9, 1977. 2 fig.

Keywords: Dairy wastes, Free-stall manure, Flushing, Lagoons, Nutrients, Land disposal, Group feeding, Economics.

The Foremost Dairy Farm of the University of Missouri at Columbia (UMC) became a ''suggestion box'' for dairymen during the Dairymen's Institute. Discussion centered on free-stall manure disposal, lagoon construction, health care and group feeding. The newest addition at UMC is a gutter flush manure disposal system in a remodeled free-stall barn. Details of the system and free-stalls were explained by Fred Meinershagen and Mark Neinheuser. Meinershagen is a UMC Extension dairy specialist and Neinheuser works at the farm. The free-stalls were raised about 6 inches above the barn floor and bedded with wood shavings. A bar placed above the cow's head makes her back before standing. This and a sloped free-stall floor reduces dirty bedding. Cows are removed from the stalls twice a day and the alley is cleaned and the tanks are dumped. Other lot manure is bladed into an open trench and flushed into the lagoon. The farm's lagoon, when full, will hold 20-acre feet of water with an average depth of 14 feet. No more than 7-acre feet are pumped from the lagoon at one time. Nutrient value of effluent from a lagoon depends on the time of year it's applied and depth from which it's pumped. As a rule of thumb, a lagoon sized to livestock numbers and operating properly should produce from 100 to 150 pounds of actual nitrogen per acre foot. The flush system was not used during a 45-day period in the worst part of winter. Other research that was discussed revealed that cows divided into groups and fed according to production can save $90 per cow per lactation in feed costs when compared to non-grouped cows. (Albertson-East Central)

4196-A1, A4, B1, C2
NITROGEN AND PHOSPHORUS: FOOD PRODUCTION, WASTE AND THE ENVIRONMENT

New York State College of Agriculture and Life Sciences, A Statutory College of the State University, Cornell University, Ithaca, New York
K. S. Porter, Editor
Nitrogen and Phosphorus: Food Production, Waste and the Environment. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1975. 372 p.

Keywords: Water pollution, Pollutant sources, Nitrogen, Phosphorus, Waste management, Pollution control, Agricultural runoff, Economics, Regulation, Model studies, Agricultural wastes.

The studies described in this book concern the interwoven issues of maintaining agricultural efficiency and protecting the environment. Special consideration was directed toward the substances nitrogen and phosphorus. Sources of nitrogen and phosphorus found in streams and lakes in central New York were identified. Estimates of the quantities involved were made and their effects on lakes were assessed with regard to management alternatives. Management of manure from treatment to direct disposal on land, and the application of fertilizer were studied. The economic consequences of applying controls to reduce nutrient losses from farm land were estimated. Finally, social issues, such as public attitudes toward pollution and the efficiency of institutions responding to such attitudes were examined in a comprehensive sociological investigation. Much effort was made to consider all the major ramifications of nutrient flows in agricultural watersheds. Consequently, the members of the research team represented the following academic disciplines: agricultural economics, agricultural engineering, agronomy, limnology, sociology, and systems analysis. The report was written for both the interested layman and the scientific community. (Merryman-East Central)

4197-A3, A4, A12, C2
TRANSPORT IN STREAMS

Department of Agronomy, Cornell University, Ithaca, New York 14853
D. R. Boulding et. al.
Chapter 3, Nitrogen and Phosphorus: Food Production, Waste and the Environment. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1975. p. 61-120. 12 fig., 23 tab., 16 ref.

Keywords: Water pollution, Pollutant sources, Nitrogen, Phosphorus, Fall Creek Watershed. New York, Agricultural runoff, Sewage.

A discussion is given of the influence of human activities on the phosphorus and nitrate removed from the Fall Creek watershed in the stream discharge. Samples were taken during both high and low discharge rates at approximately 20 locations on an irregular basis. The following conclusions were drawn concerning phosphorus: (1) In Fall Creek, the concentration of soluble phosphorus was about 30 micrograms per liter and the particulate matter contained about 110 μg P/1. Most of the latter phosphorus was carried out of the watershed during the short intervals of time when the discharge rate was very high. (2) The soluble phosphorus is probably the form most important to the biology of the lakes. (3) About 50 percent of the soluble phosphorus was attributed to non-human activities, about 25 percent was attributed to domestic sewage, and about 25 percent was attributed to farming operations. (4) Based on the Fall Creek data and numerous other considerations, the loading of soluble phosphorus to lakes in central New York can be approximated by the sum of the following inputs: (a) Sewered populations: (i) Phosphorus in laundry detergent 1.0 (±0.5) kg P/cap/yr. (ii) No phosphorus in laundry detergent 0.5 (±0.4) kg P/cap/yr. (b) Unsewered population: 0.1 to 0.4 of the values for sewered population on a per cap/yr basis. (c) Nonagricultural land: 15D mg/m^2 yr, where D is meters of stream flow per m^2/yr. Probably the range is 10D to 20D. (d) Agricultural land (in excess of 15R): 18D mg/m^2/yr, where D is meters of stream flow per m^2/yr. Probably the range is 10D to some unknown upper limit. The following conclusions were drawn in relation to nitrogen: (1) No samples were found any place at any time in which the NO_3-N concentration was a health hazard. (2) The seasonal pattern of nitrate nitrogen concentrations was similar among the years with minimum concentrations occurring during the summer and maximum concentrations occurring during the winter. (3) Corn land and domestic sewage were judged to be the most likely major sources of NO_3. (Albertson-East Central)

4198-A3, A4, A5, A7, A8, B1, C2, E2, F1, F2
FLOWS OF NITROGEN AND PHOSPHORUS ON LAND

Department of Agricultural Engineering, Cornell University. Ithaca, New York 14853
K. S. Porter, D. A. Lauer, J. J. Meisinger, and D. R. Boulding
Chapter 4, Nitrogen and Phosphorus: Food Production, Waste and the Environment. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1975. p. 123-165. 11 fig., 8 tab., 16 ref.

Keywords: Nitrogen, Phosphorus, Soil-plant system, Leaching, Volatilization, Ammonia, Land disposal, Groundwater pollution, Air quality, Crop response, Agricultural runoff, Legal aspects, Economics.

An attempt is made to determine the relationship between management of farming operations and translocation of nitrogen and phosphorus from farmed land. General characteristics of nitrogen and phosphorus in relation to the soil-plant system are outlined and overall nitrogen and phosphorus budgets are briefly discussed. Two specific investigations are described, illustrating the removal of nitrogen from land, in one case by air and in the other by water. Studies of the flow of nitrogen and phosphorus on or from soil using detailed mathematical models are also described. These models considered the management of nutrients designed to minimize the losses, while evaluating the corresponding effect on crop yield, and consequent return. Results showed that nutrient losses from agriculture cannot be entirely eliminated, but some practical steps may be taken to reduce the rate of losses. Methods of cultivation and nutrient application should be encouraged which would reduce losses with least financial penalty and possibly with a gain. (Albertson-East Central)

4199-A2, A3, A4, B1, C2, F1, F2
ECONOMIC ANALYSIS OF REDUCING PHOSPHORUS LOSSES FROM AGRICULTURAL PRODUCTION

Department of Agricultural Economics, Cornell University, Ithaca, New York 14853
G. L. Casler and J. J. Jacobs
Chapter 5, Nitrogen and Phosphorus: Food Production, Waste and the Environment. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1975. p. 169-215. 12 fig., 18 tab., 22 ref.

Keywords: Water pollution, Cayuga Lake, Pollutant sources, Pollution control, Linear programming, Model studies, Agricultural runoff, Barnyard runoff, Feedlots, Dairy industry, Economics, Regulation, Waste management.

An attempt was made to estimate the costs of reducing phosphorus inputs to Cayuga Lake from the Fall Creek watershed. In estimating costs, 3 sources of phosphorus were considered: (1) land runoff as related to soil erosion, (2) land runoff as related to manure applications, and (3) barnyard runoff. The cost of reducing phosphorus losses from land runoff was estimated by using a linear programming model of agriculture in the Fall Creek watershed. Development of the model utilized the following information: (1) production alternatives, (2) costs and returns associated with each alternative, and (3) phosphorus loss from each production practice. It was found that manure handling systems which include storage tend to decrease nutrient losses to water. However, costs of dairy manure handling would be increased by such storage and such problems as odor and flies would be increased. Consequently, trade-offs between nutrient losses to water and other environmental characteristics must be considered. Barnyard runoff was considered in relation to the 1973 EPA effluent limitation proposed guidelines for the feedlots category of point sources. These regulations were focused on large feedlots and on dairy operations having 700 or more dairy cattle. Farm business records and a runoff survey were utilized to obtain the following information: (1) distribution of farms for specified size groups; (2) barnyard area per cow for specified size groups; (3) location of the barnyard relative to a stream or road ditch; and (4) number of farms that have a barnyard. Using this information plus rainfall and cost data, the costs of constructing runoff control facilities for 3 herd sizes were computed. Study results for the entire study indicated the following. The source of phosphorus which should be reduced first was sewage. Tertiary treatment to remove phosphorus from the effluent of various sewage treatment plants discharging to the lake or its tributaries appeared to be a relatively low cost method, and should be adopted, assuming that reduction of phosphorus input to the lake beyond that achieved by a detergent phosphate ban is needed. If further phosphorus reduction is needed, barnyard runoff control should be the next priority. Last of all, manure handling practices should be considered, bearing in mind the trade-offs previously mentioned. (Albertson-East Central)

4200-A1, B1, C2, D1, D2, D3, E2

ANIMAL WASTE MANAGEMENT WITH NUTRIENT CONTROL

Department of Agricultural Engineering, Cornell University, Ithaca, New York 14853
R. C. Loehr
Chapter 6, Nitrogen and Phosphorus: Food Production, Waste and the Environment. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1975. p. 219-269. 21 fig., 15 tab., 13 ref.

Keywords: Nutrient control, Nitrogen, Land application, Application rates, Physical treatment, Chemical treatment, Biological treatment, Nitrification, Denitrification, Waste management, Poultry wastes, Animal wastes.

Alternatives for conserving and utilizing nitrogen in animal wastes include: (1) technology to conserve the nitrogen prior to land application, (2) manure application rates that match the ability of crops to utilize the available nitrogen, and (3) manure placed below the soil surface and under conditions that do not lead to denitrification or leaching losses in the soil. Type of nutrient control should be gauged by utilization of the wastes when they are applied to the land. If the wastes are intended to fertilize, nutrients should be conserved. If applied nutrients are potentially excessive, nutrients should be reduced prior to application. The latter may be achieved by physical and chemical methods, such as chemical precipitation for phosphorus and ammonia desorption or ion exchange for nitrogen. Alternatives for managing poultry wastes (some of which are applicable to other wastes) include: (1) deep pit, (2) high rise, (3) anaerobic treatment, (4) aerobic treatment, (5) soil injection, (6) dehydration, and (7) anaerobic digestion with methane production. Aerobic systems have potential for odor control, waste stabilization, ease of waste handling, and nitrogen control when needed. Oxidation ditches were studied as a means for controlling the levels of nitrogen in poultry wastes to be applied to land. Nitrogen losses were controlled by manipulating the operation of oxidation ditches. Losses were lowest when there was no attempt to cause denitrification. Losses were increased by: (1) denitrifying the mixed liquor in a separate settling unit without stopping aeration; (2) denitrifying *in situ* by stopping the aeration for an optimal time which is related to the operating condition of the oxidation ditch; and (3) designing the aeration system to provide adequate dissolved oxygen concentration initially to achieve nitrification, and have no dissolved oxygen in the rest of the ditch to achieve denitrification. Depending on mode of operation, it is possible to either conserve as much as 70 percent or remove as much as 90 percent of the input manurial nitrogen. (Albertson-East Central)

4201-B3, C1, C2, E3

INCLUSION OF LIVESTOCK FECES INTO CORN SILAGE

Department of Animal Husbandry, Michigan State University, East Lansing, Michigan 48824
M. T. Yokoyama and W. R. Nummy, Jr.
Journal of Animal Science, V. 43, No. 1, p. 211-212, July, 1976.

Keywords: Feeds, Cattle wastes, Swine wastes, Poultry wastes, Feed supplements, Refeeding, Ensiling, Corn, Nitrogen.

A laboratory study was conducted to evaluate the utilization of cattle, swine, and poultry feces as sources of supplemental nitrogen in the ensilement of whole corn plant material. Total nitrogen of cattle, swine and poultry feces were 2.16, 4.35 and 6.16 percent respectively. Fresh feces from cattle, swine and poultry were incorporated, according to their nitrogen content, at levels of 53, 23 and 16 percent respectively, and ensiled for 42 days in laboratory silos. Chemical analyses of control corn silage and corn silage with added cattle, swine and poultry feces were respectively: dry matter (percent) 38.7, 28.1, 35.7, 35.8; crude protein (percent) 6.8, 10.2, 11.2, 10.4; ether extract (percent) 3.2, 5.3, 6.8, 4.3; ash (percent) 3.1, 5.9, 5.1, 5.1; cell solubles (percent) 50.0, 44.8, 54.1, 54.2; cell walls (percent) 50.0, 55.2, 45.9, 45.8; acid detergent fiber (percent) 20.1, 25.2, 21.0, 20.6; lignin (percent) 3.3, 5.6, 3.4, 3.4; cellulose (percent) 16.1, 18.1, 17.0, 16.6; hemicellulose (percent) 22.6, 27.4, 23.6, 22.6; and insoluble ash (percent) 0.69, 1.5, 0.68, 0.65. Total nitrogen (percent were 1.08, 1.63, 1.79, 1.66. Water soluble nitrogen (percent of total nitrogen) were 44.6, 33.7, 48.4, 39.4 and ammonia nitrogen (percent of total nitrogen) were 6.1, 8.5, 17.2, 12.7. Fecal odor characteristic of each species was not entirely ameliorated by ensilement, however, fermentation did occur. Ph values were 3.9, 4.2, 3.9, 4.0 and titratable acidity (ml) were 7.5, 9.3, 12.4, 9.5. Lactic acid (percent) values were 5.09, 5.61, 8.29, 8.88 and acetic acid (percent) were 1.34, 3.87, 1.55, 1.38 Other VFA were detected in the treated silages, as a result of incorporating livestock feces. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4202-A8, B2, B5, C2, E2, F1

175 BUSHEL CORN YIELD WITH MANURE AND ONLY STARTER FERTILIZER

Beef editor
R. Watkins
Beef, V. 13, No. 6, p. A-24-A-25, Feb., 1977. 2 fig.

Keywords: Liquid wastes, Swine wastes, Corn, Fertilizers, Crop response, Economics, Plowing techniques.

Liquid hog manure and starter fertilizer produced a 175-bushel-per-acre corn yield on a 30-acre field for Hildus Wold and sons, Barry and Wayne of Mabel, Minnesota. The field did not receive the full treatment of fertilizer that was usually used because Wold wanted to see what manure alone could do. The field was probably their best. Liquid manure was applied the preceding fall at a rate of 6000 gallons per acre. The Wolds said that the key to achieving maximum nutrient value from hog manure is to knife the manure in instead of spreading it on top of the ground. This knifing procedure prevented odor and controlled water pollution due to manure runoff in the event of a heavy rain. At least $18 per acre per year was saved on the 80 to 100 acres where manure was knifed in. Fall seemed to be the best time for manure application due to less compaction of the soil at that time and the increased availability of nutrients. A disadvantage of the Wold system was conflict, during the busy spring and fall seasons, between the need to get the manure spread and the fieldwork to be done. Yield results on one field last year, which included a very dry summer, indicated a lack of response to manure. Plant population was slightly higher on the manured field and the Wolds felt that the manure may have retarded yield because some stalks were barren. Also lack of adequate rainfall may have prevented salts in the manure from being sufficiently leached away. (Albertson-East Central)

4203-A6, A10, B2, B4, D1, E2

WASTEWATER AND RUNOFF CONTROL SYSTEMS FOR DRY-LOT DAIRIES

Extension Agricultural Engineer, Riverside County, California
W. C. Fairbank and S. E. Bishop
Leaflet 2910, Division of Agricultural Sciences, University of California, Oct., 1976, 16 p. 5 fig., 3 ref.

Keywords: Dairy industry, Wastewater management, Agricultural runoff, Runoff control, California, Liquid wastes, Drylot dairies, Pond management, Odor, Vectors, Sludge management.

The California Water Quality Control Act requires that each drylot dairy have a system to control its wastewater, which is composed of washwater and manured runoff. Guidelines for planning wastewater control facilities, pond management for insect, rodent, and odor control, sludge management, and system restoration and maintenance are discussed. Before construction of a drylot waste facility starts, it is desirable to get the advice or approval of the county health department, flood control agency, and regional water quality control board. There are four typical wastewater management and disposal systems used on southern California drylot dairies: (a) washwater sump with extended levees, evaporation bed, (b) washwater sump, pasture, (c) washwater sump, mechanical separator, wastewater pond, pasture, irrigated cropland, (d) washwater sump, mechanical separator and/or sand trap, municipal sewer, pasture. There are several shortcomings which might contribute to failures of wastewater and runoff control systems: (a) inadequate diversion of clean water, (b) inadequate collection and retention capacity, (c) unreadiness of the system for reuse after sudden, large inputs of storm water, drainage, or wastewater, (d) excessive sludging from very fine suspended solids caused by repeated recycling of pond water through the confinement areas, and (e) routine input of manure solids to that part of a pond system intended for storm runoff storage. Appendices state: (a) basic assumptions in calculating quantity of waste produced and natural losses, (b) sample calculations for wastewater management, and (c) rainfall data for the major dairy in southern California. Planning help is available from University of California Cooperative Extension farm advisors, the U. S. Soil Conservation Service, and private dairy contractors and consultants. (Albertson-East Central)

4204-A9, A10, B1, D2

FEED-THROUGH LARVICIDE KILLS MAGGOTS IN MANURE

Anonymous
Animal Nutrition and Health, V. 32, No. 4, p. 5, 19, May, 1977. 2 tab.

Keywords: Feed additivies, Larvicides, Insecticides, Fly control, Stirofos, Methoprene, Cattle manure, Maggots.

Stevenson Moore III, professor of Agricultural Entomology at the University of Illinois, used stirofos in demonstration tests to kill fly maggots in manure. Stirofos was fed free choice in medicated blocks to pastured cattle in four herds and blended into the concentrate feed and fed to one additional dairy herd. The additional dairy herd was also sprayed with 1.25 percent water-base Ciovap at 1-2 oz./animal. A neighboring dairy herd with similar pasture and management practices received only the Ciovap spray treatment. The stirofos medicated blocks fed free choice to the four herds of pastured cattle provided 90 percent reduction of horn flies, 51 percent reduction of face flies, and 9 percent reduction of stable flies. The herd receiving the stirofos in concentrated feed coupled with a Ciovap spray as needed showed a 99 percent reduction of horn flies, a 74 percent reduction of face flies and 46 percent reduction of stable flies. The research indicates that feed-through insecticides alone do not kill adult flies and will not reduce to a satisfactory level the complex of some flies such as stable flies and face flies that attack pastured cattle. Insecticide sprays applied to animals still seem to be the most effective way to control flies on pastured cattle. (Albertson - East Central)

4205-A11, C1, C2, D1
WASTE CHARACTERIZATION STUDIES FOR RACEWAY PRODUCTION OF CATFISH

Department of Civil Engineering, Tennessee Technological University, Cookeville, Tennessee 38501
J. A. Gordon
Industrial Wastes, V. 21, No. 6, p. 28-31, Nov.-Dec., 1975. 3 fig., 1 tab.

Keywords: Fish wastes, Catfish production, Physical properties, Chemical properties, Waste treatment, Settling, Ammonia, Phosphate, Suspended solids, Biochemical oxygen demand, Chemical oxygen demand.

Waste characterization studies resulted in the recommendation of settling as the only waste treatment process for use at the Gallatin catfish project, operated under a joint agreement between Cal Maine Foods of Jackson, Mississippi and the Tennessee Valley Authority. The facility consisted of 10 concrete raceways which received heated condenser discharge water from the Gallatin Steam Plant. Each raceway was 50 ft. long by 4 ft. wide by 4 ft. deep. Water depth was held at 3.5 ft. during the studies. Stocking densities were as follows: (a) raceways 1, 2, and 3 -- 10,000 fish, (b) raceways 4, 8, 9, and 10 -- 15,000 fish, (c) raceways 5, 6, and 7 -- 20,000 fish. The studies showed that production of organic nitrogen and nitrate plus nitrite was negligible during the rearing process. Settleable solids were very low and the solid particles settled rapidly. The total volatile solids were about 25 percent of the total solids. Chemical oxygen demand (COD) was used as a check on biochemical oxygen demand (BOD) and as such was not analyzed. A brief long-term BOD study showed that 5-day BOD was an adequate measure of organic strength. Predictive equations were developed for BOD, ammonia, and phosphate. Problems in either analytical or field procedures coupled with an inadequate understanding of solids production by catfish resulted in poor interpretation of the solids data. (Albertson-East Central)

4206-A6, B2, C1, C2, D2
CHEMICAL CONTROL OF HYDROGEN SULFIDE FROM ANAEROBIC SWINE MANURE I. OXIDIZING AGENTS

Agricultural Engineering Branch, British Columbia Department of Agriculture, Abbotsford, British Columbia, Canada
E. M. Barber and J. B. McQuitty
Canadian Agricultural Engineering, V. 17, No. 2, p. 90-96, Dec., 1975. 7 fig., 6 tab., 10 ref.

Keywords: Swine wastes, Hydrogen sulfide, Odor, Chemical oxidizing agents, Anaerobic conditions, Ammonium persulfate, Potassium permanganate, Sodium nitrate.

The effects of three chemical oxidizing agents on the evolution of hydrogen sulfide from anaerobic swine manure were investigated in a series of exploratory laboratory-scale incubation trials. Sodium nitrate, potassium permanganate and ammonium persulfate were shown either to delay or to eliminate the release of sulfides from the treated manure. Both persulfate and permanganate also appeared to reduce the odor-offensiveness of the treated manure compared to untreated controls. The results of these trials suggest that a more detailed economic analysis and evaluation of chemical oxidizing agents may be warranted. (Copyright 1975 - Canadian Agricultural Engineering)

4207-A8, B1, C1, C2, C3, D1, D3, E2, E3, F1
STATE-OF-THE-ART: SWINE WASTE PRODUCTION AND PRETREATMENT PROCESSES

Biological and Agricultural Engineering Department, North Carolina State University, Raleigh, North Carolina 27607
M. R. Overcash and F. J. Humenik
Environmental Protection Agency Report EPA-600/2-76-290, Dec., 1976, 171 p. 24 fig., 53 tab., 241 ref.

Keywords: Swine wastes, Waste treatment, Waste disposal, Land application, State-of-the-art, Housing, Feedlots, Confinement pens, Physical properties, Chemical properties, Biological properties, Lagoons, Anaerobic conditions, Aerobic conditions, Oxidation, Anaerobic digestion, Recycling, Methane, Separation techniques, Pyrolysis, Refeeding, Composting, Economics.

A review of waste generation and pretreatment processes was compiled, expanded, and interpreted for the swine production industry. Typical swine units based upon waste management techniques were detailed as concrete slab facilities, slotted floor-pit units, and swine drylot or pasture operations. This approach was used instead of actual or theoretical raw waste defecation data becasue the defecated waste load has not been documented for producer facilities. Pretreatment processes for the production unit waste load were evaluated in relation to land as the terminal receiver and for waste conversion mechanisms affecting utilization processes. The pretreatment effects on waste constituents were examined for all forms of nitrogen, cations or salts, organics, microbial or pathogen content, and nuisance factors. The state-of-the-art report confirmed the large number of definitive studies on various pretreatment processes and the characterization of swine waste. The need to augment the current technical base with economic analyses of field systems was the principal recommendation. (Overcash-North Carolina State University)

4208-A11, B3, C2, E3
FERMENTATION, NITROGEN UTILIZATION, DIGESTIBILITY AND PALATABILITY OF BROILER LITTER ENSILED WITH HIGH MOISTURE CORN GRAIN

Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
L. F. Caswell, K. E. Webb, Jr., and J. P. Fontenot
Journal of Animal Science, V. 44, No. 5, p. 803-813, May, 1977. 8 tab., 35 ref.

Keywords: Fermentation, Broiler litter, Ensiling, Corn, Refeeding, Digestibility, Nitrogen balance, Cattle, Performance.

Ground corn grain (26.3 percent moisture) was ensiled alone and in a 2 to 1 ratio with ground litter (18.7 percent moisture). The pH of the ensiled high moisture corn grain was lower ($P < .01$) than that of the ensiled corn-litter mixture. Lactic and acetic acid levels were similar for the two fermented materials. Ensiling the corn-litter mixture resulted in markedly reduced total bacteria and coliform numbers. Crude protein content of the ensiled corn-litter mixture was 20.1 percent, dry basis, compared to 9.4 percent for ensiled corn grain. Twenty-four wethers were used in a digestibility and nitrogen balance trial and 12 steers were individually fed in two palatability trials. The four rations tested in both studies contained: 1) unsupplemented ensiled corn; 2) ensiled corn supplemented with dry heat processed litter (260 C at a depth of 1.3 cm for 30 min); 3) ensiled corn supplemented with soybean meal; or 4) the ensiled corn-litter mixture. Nitrogen retention was lowest ($P < .01$) for the lambs fed the unsupplemented ration and was higher ($P < .01$) for those fed soybean meal than for those fed the litter-containing rations. Coefficients of apparent digestibility were usually lower ($P < .01$) for the unsupplemented ensiled corn ration than for rations containing litter or soybean meal. Apparent digestibility of crude protein was lower ($P < .01$) for both litter-containing rations than for the soybean meal supplemented ration, but the other digestion coefficients were not significantly different among the supplemented rations. Dry matter intakes tended to be higher for cattle fed processed or ensiled litter than for those fed the soybean meal supplemented ration. (Copyright 1977-Journal of Animal Science)

4209-A4, A5, A7, A8, B1, C2, E2
SWINE PRODUCTION INDUSTRY WASTE CHARACTERIZATION AND MANAGEMENT

Biological and Agricultural Engineering Department, North Carolina State University, Raleigh, North Carolina
F. J. Humenik, M. R. Overcash, and L. B. Driggers
Agricultural Waste Management, North Carolina State University, Raleigh, North Carolina, 1973, 58 p. 4 fig., 23 tab., 32 ref.

Keywords: Swine wastes, Open lots, Housing, Slotted floors, Soil contamination, Water

pollution, Groundwater pollution, Air pollution, Agricultural runoff, Infiltration, Heavy metal, Copper, Zinc, Phosphorus, Nitrogen, Chemical oxygen demand, Effluents, Land application.

It is estimated that in 1972 approximately 15 million swine were grown in slotted floor buildings, 25 million on solid concrete floor facilities, and 65 million in open dirt or pasture lots. The literature indicates that less than 10 percent of waste defecated on pasture or dirt lot will be transported in runoff or waste load leaving such a swine production unit. Further estimates to assess waste load from swine pasture, dirt or concrete pad units suggest a proportional relationship of about 1 percent to 10 percent of the raw waste load for swine densities between 10 to 3000 animals/acre. Soil and groundwater contamination become factors at intermediate stocking densities. Heavy metal feed additive copper and zinc or phosphorus waste loads are related to amounts of organics or soil transported from the pasture or dirt lot production unit in surface runoff. Runoff and infiltration quantities and qualities are unique to each particular site. Chemical oxygen demand and all forms of nitrogen (ammonia, organic and nitrate) are considered the most technically sound, convenient and non-redundant measures to evaluate the pollutional potential of effluent for discharge to surface waters from a swine production unit. Compliance with the COD-nitrogen criteria will assure amelioration of all waste parameters except ions and medicinals. Therefore additional specific parameters corresponding to particular waste amendments may be imposed upon producers employing feed additives if compliance with the COD-nitrogen criteria does not assure adequate removals. The effect on such receiver systems as air, soil and groundwater must also be considered. Thus effluent criteria for soil receiver systems based upon nitrogen, salts and heavy metals, within the constraint that no runoff occurs during a disposal event and that any point-source rainfall-snowmelt runoff comply with COD-nitrogen criteria for effluent disposal to surface waters, has been suggested pursuant to the protection of soil, soil-water and surface waters where terminal land application is practiced. (Merryman-East Central)

4210-A11, A12, C2, E3

INFLUENCE OF FEEDING DEHYDRATED POULTRY WASTE ON COMPOSITION AND ORGANOLEPTIC QUALITY OF MILK

University of California, Davis, California 95616
J. C. Bruhn, G. D. Reif, H. Toone, and J. H. Evans
Journal of Food Protection, V. 40, No. 1, p. 29-31, Jan., 1977. 6 tab., 13 ref.

Keywords: Refeeding, Dried poultry wastes, Dairy cattle, Performance, Milk quality, Chemical properties, Public health.

A double reversal trial with three, 4-week periods was used to determine the effect on milk quality of feeding dehydrated poultry waste to lactating cows. Fifteen cows were fed a control ration for 4 weeks (Period 1), followed by an experimental ration containing dehydrated poultry waste for 4 weeks (Period 2), and then by the control ration for 4 weeks (Period 3). Milk was collected daily and scored by five judges using the ADSA milk flavor scoring guide. Milk composition (fat, protein, lactose, and solids-not-fat) was determined on alternate days. During Periods 2 and 3 weekly composite samples were collected to determine concentrations of cadmium, copper, lead, zinc, and tocopherol. No significant differences were found in any of the milk quality factors studies. (Copyright 1977 - Journal of Food Protection)

4211-A8, B3, B5, C3, E2

FEEDLOT MANURE TOP DRESSING FOR IRRIGATED PASTURE: GOOD AGRICULTURAL PRACTICE OR A HEALTH HAZARD?

Agriculture Canada Research Station, Lethbridge, Alberta, Canada T1J4B1
R. G. Bell, D. B. Wilson and E. J. Dew
Bulletin of Environmental Contamination and Toxicology, V. 16, No. 5, p. 536-540, Nov., 1976. 4 tab., 12 ref.

Keywords: Cattle manure, Feedlots, Land application, Crop response, Forages, Irrigation, Pathogenic bacteria, Fecal coliforms, Sunlight.

Top dressing a spray-irrigated pasture of orchardgrass with 125 t/ha of overwintered beef feedlot manure almost doubled the yield of dry forage: 6353 kg/ha vs. 3578 kg/ha for the plots receiving no manure. Even at this rate of application, the manure did not contaminate the irrigated grass with enteropathogenic bacteria after irrigation. When the grass became contaminated through the use of fecally polluted irrigation water, the fecal coliforms, indicator organisms with survival characteristics similar to the salmonellae, were effectively eliminated from the grass after exposure to 65 hr of bright sunlight. (Copyright 1976 Bulletin of Environmental Contamination and Toxicology)

4212-A8, B2, B5, C2, E2

LIQUID MANURE CAN SERVE AS SOURCE OF NUTRIENTS

Anonymous
Prairie Farmer, V. 149, No. 58, p. 62-63, April 2, 1977. 1 fig.

Keywords: Cattle manure, Liquid wastes, Land application, Crop response, Fertilizers, Nitrogen, Phosphates, Potash, Corn.

A three-year study (1973-1975) on the use of liquid cattle manure as the major source of nutrients for corn was conducted by Ernest Vandermeer, operator of Will-O-Wick Farm, Newark, Illinois. Test strips of varying fertility were set up. On some, Vandermeer applied manure only. On others he applied 80 lb. phosphate and 60 lb. potash. He applied nitrogen, with the phosphate and potash, at levels of 0, 80, and 160 lb. In 1973, based on visible observations, no differences in production of the various strips were indicated. 1974 yield results indicated no significant differences among the various fertility levels. However, the moisture content of the grain was slightly higher where manure was the only fertilizer material. In 1975, test strips with 240 lb. of nitrogen plus 80 lb. of phosphate and 60 lb. of potash were added. There were also strips with 75 lb. nitrogen along with manure -- no phosphate and potash. Yield results indicated no statistical difference in production. Yields ran from about 147 to 154 bushels per acre. As a result of the 1973-1975 testing, Vandermeer has virtually eliminated commercial phosphate and potash on his fields. However, he still applies 50 lb. of nitrogen. (Bates - East Central)

4213-A5, A8, B1, C2

SOLUBLE CATIONS BENEATH A FEEDLOT AND AN ADJACENT CROPPED FIELD

Agricultural Research Service, U. S. Department of Agriculture, Lincoln, Nebraska
L. F. Elliott, T. A. Travis and T. M. McCalla
Soil Science Society of America Proceedings, V. 40, No. 4, p. 513-516, July-Aug., 1976. 2 tab., 8 ref.

Keywords: Feedlots, Cations, Sampling, Soils, Groundwater pollution, Soil water movement, Sodium, Potassium, Calcium, Magnesium, Zinc, Copper, Iron, Manganese.

The purpose of this study was to determine potential or possible movement of cations to groundwater by measuring cations in the soil solution beneath a feedlot and an adjacent cropped field. Soil solution samples were studied for a 12 month period. Concentrations of sodium, potassium, calcium, magnesium, zinc, copper, iron, and manganese were determined. Only calcium, magnesium, and mangenese were higher in the feedlot soil solution than in the cropped field at the lower depths tested. At these depths, calcium and magnesium were 2 to 4 times higher in soil solution from the feedlot than from the cropped field. While manganese was consistently higher beneath the feedlot than the field, manganese levels were low. Although some dissolved cations were slightly above EPA recommended values, only slight dilution by the aquifer would be required. If the feedlot is kept stocked and the manure interface is kept intact, pollution of the aquifer by any of the cations tested is unlikely. (Rowe - East Central)

4214-A6, A11, B2, C1, C2, D3

AERATION UNDER CAGED LAYING HENS

Agricultural Research Service, U. S. Department of Agriculture, Ithaca, New York
A. G. Hashimoto
Transactions of the ASAE, V. 15, p. 1119-1123, 1972. 11 fig., 2 tab., 13 ref.

Keywords: Aeration, Poultry wastes, Slurries, Chemical analysis, Odor, Physical properties, Chemical properties, Performance, Poultry.

Research was conducted at the Cornell Agricultural Waste Management Laboratory to evaluate the feasibility and effectiveness of a diffused air aeration system under caged laying hens. The study was held in 2 separate trials in a room 14 ft. 9 in. by 46 ft. 6 in. and equipped with conventional stair-step cages which housed 226 White Leghorn laying hens. Manure from the caged poultry fell into a tank to which water was added at the start of each trial. The contents were aerated by means of an air blower and diffuser. The mixed liquor in the tank was not allowed to overflow and tap water was added periodically to replace water lost through evaporation. Samples of manure entering the tank were collected over a 24 hr. period on plastic sheets placed on a platform under a cage of chickens. These samples were collected and analyzed 2 or 3 times a week. Liquid "tank samples" were collected at random locations. A composite sample was obtained by sampling at the surface, middle and bottom of the tank. The analyses performed on the fresh and tank samples were: total solids, fixed solids, ammonia, organic nitrogen, nitrate, nitrite, carbon, and chemical oxygen demand. Also the gaseous ammonia concentration and odor offensiveness of the room air and the temperature and pH of the aerated slurry were monitored. Study results revealed that significant removals of volatile solids, total nitrogen and carbon are possible with diffused air aeration systems treating poultry manure slurries. Odor offensiveness was decreased markedly when nitrification was maintained. Egg production and bird mortality were not adversely affected. Problems with increased humidity and excess condensation were not apparent. Examination of power requirements, loading rates, oxygenation capacity and other design parameters is in progress. (Albertson - East Central)

4215-A11, B3, D1, D2, E3
PELLETED POULTRY LITTER -- ECONOMICAL CATTLE FEED

Anonymous
Poultry Digest, V. 36, No. 420, p. 90, Feb., 1977.

Keywords: Litters, Refeeding, Cattle, Performance, Rations

According to Ron Steingrebe of Foster Farms, Livingston, California, broiler litter that is processed, heat treated and pelleted or crumbled has as much feeding value as alfalfa meal when used as part of the ration for feeder steers. It is also more economical than alfalfa. Kopro, as the Foster Farm by-product is known, showed that: (1) daily gains, feed consumption, and feed conversions are the same for all combinations of Kopro and alfalfa, (2) there is no problem of residues, heavy metals, antibiotics or pesticides in the tissues of the beef cattle, and (3) there are no significant differences in the carcass data at any tested treatment levels. Kopro can also be used as mineral supplement for feedlot rations, or in large quantities in growth and maintenance rations by mixing it with silage or pelleting it with other ingredients such as corn, wheat, barley or crop residues. Steingrebe believes that poultry litter should be considered a valuable by-product instead of just waste. (Albertson - East Central)

4216-B1
FINDING WAYS TO USE THE VALUABLE PLANT NUTRIENTS IN POULTRY MANURE

Professor of Poultry Science, University of Connecticut, Storrs, Connecticut 06268
W. A. Aho
Milestones, V. 17, No. 1, p. 4-6, Fall/Winter, 1974. 3 fig.

Keywords: Agricultural wastes, Waste management, Connecticut.

The Connecticut Farm Waste Management Committee was established in 1968 by Dean Edwin J. Kersting of the College of Agriculture and Natural Resources at the University of Connecticut to help farm families concerned with handling agricultural wastes in a satisfactory manner. The committee is made up of agricultural producers, agricultural businessmen, extension specialists, researchers from the Agricultural Experiment Stations at Storrs and New Haven, personnel from the Soil Conservation Service, and representatives from such regulatory agencies as the State Department of Environmental Protection, the State Department of Health, and the Dairy Division of the State Department of Agriculture. One of their first official actions was to assemble a group of personnel to visit a number of commercial farm operations in the state. Some of the problems they observed were those caused by the high density confinement of cattle and poultry, which has generally compounded the problems of waste utilization or disposal because of the few acres of land available on most Connecticut farms. The outcome of these visits has been the realization that farm manures can no longer be considered as merely a disposable; rather, they must be utilized for their plant nutrient content. The committee has published three leaflets which present helpful information on the manure problem to agricultural producers. Free copies of these leaflets are available from Agricultural Publications, Box U-35, College of Agriculture and Natural Resources, University of Connecticut, Storrs, Connecticut 06268. (Albertson-East Central)

4217-A5, A8, B1, C2
SOIL POLLUTION FROM FEEDLOTS IN GEORGIA

Agronomist. U. S. Army, Ft. Gordon, Georgia
H. W. Fordham and J. Giddens
Georgia Agricultural Research, V. 15, No. 4, p. 17-19, Spring, 1974. 8 fig.

Keywords: Groundwater pollution, Soil contamination, Feedlots, Cattle, Georgia, Sampling, Nitrates, Nitrites, Phosphorus, Potassium, Calcium, Magnesium, Salt, Organic matter.

A survey was made of 21 beef cattle feedlots in Georgia to determine possible soil and groundwater pollution. The total number of cattle in each feedlot operation varied, but stocking rates averaged about 200 per acre. Soil samples were taken upslope from the lots to represent control samples. The samples were analyzed for nitrate and nitrite after water extraction and for phosphorus, potassium, calcium, and magnesium after extraction with dilute acid. Salt content was determined by electrical conductivity and organic matter was determined by wet oxidation. Average soil nitrate nitrogen content of topsoil in feedlots was less than 20 ppm, although in one lot it reached 56 ppm. Less nitrate was found in topsoil downslope than in the feedlot. Nitrate found in downslope soils probably resulted largely from wastes in feedlot runoff which infiltrated into the soil after being deposited below. Phosphorus, calcium and magnesium did not increased greatly in the feedlots or downslope from lots except in the surface 12 inch depth. Potassium content of feedlot soils was very high in the surface. However, the potassium concentration in feedlot soils did not reach a toxic level. Salt content did reach the toxic level in feedlot soils. Study results indicated that pollution of groundwater from beef cattle feedlots in Georgia was probably not significant. Runoff of wastes from the feedlots had more potential as a pollution problem than dissolved nutrients in groundwater. (Rowe - East Central)

4218-A8, B5, C2, E2
SOIL NITROGEN. IX. THE EFFECTS OF LEYS AND ORGANIC MANURES ON THE AVAILABLE-N IN CLAY AND SANDY SOIL.

Agricultural Research Council, 160 Great Portland Street, London, W1N 6DT, England.
Grasser, J. K. R. and Kalembasa, S. J.
Journal of Soil Science, V. 27, No. 2, p. 237-249, June, 1976. 3 fig., 7 tab., 14 ref.

Keywords: Organic wastes, Land application, Crop response, Ryegrass, Nitrogen, Farmyard manure.

The effects of varying the forms and amounts of orgnaic matter produced by field treatments of clay and sandy soils, on yields of grass grown in these soils in pots in the glasshouse, on measurements of total-N and available-N, and on their intercorrelations were investigated. Field treatments on these soils were: (1) 8 treatments of sandy soils from Stackyard, Woburn -- no organics, no organics, peat, green manures, straw, farmyard manure, grass-clover ley, grass ley with N; (2) 5 treatments of clay soils from Highfield, Rothamsted -- permanent fallow 1948-71, Lucerne ley, grass-clover ley, grass ley with N, permanent grass; and (3) 2 treatments of clay soils from Barnfield, Rothamsted -- minerals with N and farmyard manure. These soils were each used to grow ryegrass with and without add fertilizer-N. Aerobic incubation, anaerobic incubation and nitrogen extracted by boiling water seemed the most suitable methods for examining the effects of treatments in the field on the correlations between crop performance in the glasshouse and laboratory measurements of available-N in the soils. The experimental results showed the the field treatments had altered both the quantity of organic matter in the soil and its C/N ratio. The laboratory measurements were able to predict the availability of N in these soils to grass grown in the glasshouse when other factors were not limiting. In the field, nitrogen supply may not be the major factor, and until the other factors controlling plant growth and their interaction with N supply can be quantified, the predictive value of laboratory measurements of available-N must be greatly diminished. Future work should be done to investigate and quantify these factors, if possible. (Albertson-East Central)

4219-B2, B3, C1, C2, D1, E2, E3, F1
SOLID VS. LIQUID WASTE: PRE-POND WASTE SEPARATION ALLOWS FLUSH RECOVERY RECYCLING

Editorial Director, Feedlot Management
G. Ashfield
Feedlot Management, V. 19, No. 4, p. 26, 28, April, 1977. 1 fig.

Keywords: Separation techniques, Cattle manure, Liquid wastes, Solid wastes, Flushing, Irrigation, Refeeding, Economics.

Con Gilbertson, University of Nebraska agricultural engineer, feels that separation of feedlot beef manure into its solid and liquid portions is inevitable in many confined feedlot situations. Method of separation and use of the byproducts is what makes a difference in profitability and labor efficiency. For a flush type confinement system, Gilbertson suggests that a separation process take place so that the liquids may be utilized for flushing other wastes. A typical beef flush system can use the waste for 5-6 flushes. The easiest separation technique is hydraulic separation. This means that the wastes are run into a temporary holding pond and the liquids are drained off the top. Later, when the liquid is gone, the solids can be cleaned out with a front-end loader. Wastes can also be separated by a mechanical separator such as a screw, rotary, vibrating or shaker system that drops the solids out and allows the liquid to continue on to a holding tank or pit. This system necessitates a small, temporary holding pit at the end of the confinement facility that contains a pump for forcing the manure through the separation process and into the holding area. Waste separation reduces plugging problems in field spreading by irrigation. Also, the liquid wastes still retain most of the nutrients which would be valuable to crop land. While refeeding of only the solid portion of the wastes would result in substantial loss of potential nutrient benefit of the manure, Gilbertson feels that the solid portion could go back in the diet of feedlot steers or brood cows. A determination needs to be made as to how long it is profitable to keep recycling the liquid wastes and when it is optimal to apply it to the fields for crop production. (Rowe-East Central)

4220-A11, A12, C2, C3, D1, D2, D3, E3

THE VALUE OF ANIMAL WASTES AS FEEDS FOR RUMINANTS

Virginia Polytechnic Institute and State University, Blacksburg, Virginia
J. P. Fontenot and K. E. Webb, Jr.
Feedstuffs, V. 46, No. 14, p. 29, April, 1974. 41 ref.

Keywords: Refeeding, Cattle manure, Wastelage, Poultry litter, Poultry wastes, Ruminants, Performance, Copper toxicity, Animal health, Public health.

Certain animal wastes appear to have substantial nutritional value for ruminants. Cattle manure may be mixed with hay and fermented to produce wastelage. It has been found that the wastelage will produce satisfactory performance in breeding ewes and beef cows when supplemented with vitamin A. Substantial decreases in fibrous content which increases in vitro cell wall digestibility have resulted from the treatment of cattle feces with certain chemicals. Poultry litter and caged manure wastes are high in crude protein, and ruminants efficiently utilize the nitrogen. By heat treatment or a combination of chemical and heat treatment, wastes can be pasteurized and rendered free of pathogenic organisms. There have been no reports of disease problems from including poultry wastes in practical rations for beef cattle and sheep. The only harm to ruminants fed recycled animal wastes has been copper toxicity in sheep fed litter containing high copper levels and reproductive problems in cattle fed litter which contained estrogenic activity. Pesticide residues present no serious problems in poultry litter or in the meat from animals fed the wastes. The only deterrent to widespread acceptance of refeeding animal wastes is the medicinal drug residue problem. However, this problem does not appear to be serious. There is sufficient information available to conclude that certian wastes can be recycled by feeding without presenting hazards to human and animal health. (Rowe - East Central)

4221-B2, B3, C2, D3, E3

METHANE RECOVERY FROM POULTRY WASTE

MONTECO - Environmental Management Associates, Montgomery, New York
A. C. Anthonisen and E. A. Cassell
Paper No. NA 74-106, American Society of Agricultural Engineers, 1974 Annual Meeting, University of West Virginia, August 18-20, 1974, 26 p. 11 fig., 2 tab., 21 ref.

Keywords: Poultry wastes, Sewage sludge, Recycling, Methane, Sodium chloride, Feasibility studies, Anaerobic digestion.

A laboratory study was conducted to: (1) determine the feasibility of producing methane during the digestion of chicken manure, (2) compare the digestion of chicken manure to the digestion of domestic sludge and (3) compare the digestion of chicken manure with a concentration of sodium chloride to antagonize the effects of ammonia to the digestion of chicken manure without sodium chloride. The research was conducted in 3 laboratory digesters maintained under identical experimental conditions. Experimental procedures are outlined. Experimental results indicated the following: (1) The following condtions appear to provide environment under which chicken manure can be anaerobically digested -- (a) pH - 7.4, (b) volatile acids (1,500 mg/1 - above), (c) alkalinity (10,000 mg/1 - 12,000 mg/1), (d) ammonia nitrogen (1,500 mg/1), (e) detention time (20 days), (f) loading (.088 lb VS/day/ft), and (g) temperature (35 degrees C). (2) The conversion of volatile acids to methane gas appears to be inhibited when ammonia nitrogen concentrations reach 1250 mg/1. (3) The gas from the digestion of chicken manures is burnable. (4) Additional research at a pilot plant level is necessary to determine the economic feasibility of recovering methane from chicken manure on operating poultry farms. (Rowe-East Central)

4222-B1, D3, E3, F1

UTILIZATION OF BIOGAS FOR FARM PRODUCTION ENERGY

Institute for Man and Environment, State University of New York, Plattsburg, NY
D. W. Williams, T. R. McCarty, G. R. Morris, W. W. Gunkel, D. R. Price
Transactions of the ASAE, V. 19, No. 6, p. 1034-1040, 1044, November - December, 1976. 5 fig., 2 tab., 21 ref.

Keywords: Recycling, Energy, Biogas, Dairy manure, Cattle manure, Economics, Feasibility studies, Feedlots, Anaerobic digestion.

Specific study objectives were: (1) Document energy uses on typical 100-cow dairy farms and 1000-head beef feedlots. The quantities of direct energy used for farm production and family living were determined including diesel fuel, gasoline, heating oil, and electricity. (2) Compare potential biogas energy production from anaerobic digestion of manures on these farms, with month-by-month distribution of direct energy uses, in order to assess how well energy production would match energy demand. (3) Assess the technical and economic feasibility of converting various energy-using equipment on the farms to biogas consumption. (4) Assess problems associated with handling and storage of biogas, with respect to requirements of the energy-using equipment. (5) Determine optimum biogas use systems for dairy and beef farms with respect to maximum use of available gas, and least cost per unit of energy consumed. Assuming that anaerobic digester costs are to be borne by the waste disposal system and keeping in mind that current conclusions are preliminary since the study is only 60 percent completed, the following conclusions were drawn: (1) On a 100-cow dairy using present day energy prices, the most economically feasible alternative is to convert all furnaces, space heater, water heaters, and home heating and cooking appliances to biogas. The rest of the gas would be used for digester heating. (2) The electricity alternative would be economically feasible on the 100-cow dairy farm if electricity prices were at or above 3.5¢ per kWh. (3) For biogas replacement of gasoline on a dairy farm to be feasible, gasoline prices would have to double from the present 49¢ per gal. (4) Using the gas both for heating and gasoline replacement would supply about 2/3 of the total direct energy needs of the dairy farm. This alternative would be technically feasible but not economically feasible unless gasoline prices increase substantially. (5) The most economically attractive alternative for using the biogas produced from a 1000-head beef feedlot appeared to be the generation of electricity for both feedlot use, and sale of a utility company. (6) If the biogas from the 1000-head feedlot is used for direct energy replacement of home heating fuel and appliance heating, and gasoline, about 57 percent of the total direct energy needs of the feedlot farm could be satisfied. However, for such a system to be economically feasible, gasoline prices would have to increase to $1.25 per gal. (Rowe-East Central)

4223-A11, B3, C2, D1, E3

EFFECTS OF DAIRY CATTLE MANURE SOLUBLES IN LAMB DIETS

Agricultural Research Service, U. S. Department of Agriculture, NER, A. P. G. I., Maryland
L. W. Smith and I. L. Lindahl
Journal of Animal Science, V. 43, No. 1, p. 211, July, 1976.

Keywords: Dairy manure, Refeeding, Sheep, Performance, Nutrients, Ground corn cobs.

Four trials with 18 lambs (initial weight 28.1 kg) each were conducted to determine the effect of dried dairy cattle manure solubles on digestibility and efficiency of utilization of dietary nutrients for growth. Solubles were expressed from manure with a screw press and mixed with ground corn cobs in ratios of 0:1, 1:1, or 2:1 w/w. Composition of solubles were: DM, 8 percent and N, 5.4; Ash, 24; Ca, 2; P, 2; Cd, .001; Fe, 2.5; Cu, .03; and Zn, .3 percent of DM. The wet mixtures were dried in a rotatory drum dehydrator with exhaust at 85 C. The calculated percentage of DM from the solubles in the corn cob mixtures were: I, 0; II, 8; and III, 15. The lamb diets contained corn, 40; soybean meal, 6.4; alfalfa meal, 12.5; salt, .5; dicalcium phosphate, .6; and one of three sources of corn cobs, .40 percent. The basal diet was formulated to contain 64 TDN, 1.5 N, 0.38 Ca, and 0.32 percent P. Digestibilities were determined from 5-day total fecal and urinary collections after completion of 45-day continuous growth trials. Differences ($P < .05$) were observed among trials for digestibility and growth. Digestibilities did not differ ($P > .05$) due to treatment and means were: DM, 59; organic matter, 60; cell walls, 40; and N, 56 percent. Daily N retention averaged 3.8 g and did not differ ($P > .05$) due to treatment. Lamb performance did not differ ($P > .05$) due to treatment and means were: daily organic matter intake, 1.23 kg; average daily gain, 216 g; digestible organic matter for growth, 346 g; and gross organic matter conversion, 3.5 kg/kg. Lamb performance and nutrient utilization were not adversely affected by these levels of dietary additions of manure solubles. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4224-A8, B3, B5, C2, E2
SOIL CHARACTERISTICS AND CORN YIELD AS AFFECTED BY PREVIOUS APPLICATIONS OF POULTRY MANURE

Associate Professor, University of Delaware, Newark, Delaware
W. C. Liebhardt
Journal of Environmental Quality, V. 5, No. 4, p. 459-462, 1976. 6 tab., 11 ref.

Keywords: Poultry manure, Land application, Crop response, Soil properties, Corn Yields, Soil salinity, Dry matter production, Nutrient concentration.

The effect of poultry manure applied during 1971-1973 on the corn yield and soil characteristics of 1974 and 1975 was studied. Plots of Elkton loamy sand with six levels of poultry manure application (0, 22, 56, 90, 168, and 224 metric tons/ha), three levels of chemical fertilization [224-5-18 kg/ha (N-P-K)], plus 22 metric tons/ha poultry manure with 224-5-168 kg/ha (N-P-K) were established with four replications for three years (1971, 1972, 1973). Corn (*Zea mays* L.) was grown on these plots for five years (1971-1975) with no soil amendments applied in 1974 and 1975. Soil salinity in 1974 was substantially reduced from previous poultry manure application. This was primarily due to the leaching rain in the winter. Consequently, corn production yields did not experience the typical reduction that accompanied 1971-1973 poultry manure applications. Ear leaf at silking, whole plants, and grain samples showed no problem with toxicity from previous poultry manure application. This research indicates that excessive poultry manure applications won't be a problem in Delaware's sandy coastal plain soils, except in the year that it is being applied. (Bates - East Central)

4225-A11, B2, C2, D3, E3
RECYCLING SWINE WASTE

Animal Science Department, University of Illinois, Urbana, Illinois
B. G. Harmon
Paper presented at National Feed Ingredients Conference, Des Moines, Iowa, June 17, 1975, 17 p. 9 tab., 13 ref.

Keywords: Swine wastes, Oxidation ditch mixed liquor, Aerobic treatment, Anaerobic treatment, Refeeding, Nutrients, Nitrates.

University of Illinois studies utilizing oxidation ditch treatment of swine wastes have resulted in the following observations: (1) Swine waste provides an excellent substrate for building single cell protein. (2) Aerobically treated swine wastes have more feeding value than anaerobically treated swine wastes. (3) Oxidation ditch mixed liquor (ODML) is rich in amino acids, vitamins, and minerals. (4) Pigs offered ODML as the only source of water from 85 pounds to market weight gained more rapidly and efficiently than pigs given tap water. (5) More information is needed concerning the influence of nitrates in the oxidationd itch. Periods of poorest performance of animals correspond with intake of oxidation ditch mixed liquor when nitrate levels are at their highest. (6) The entire oxidation ditch system can utilize all or nearly all the waste produced by swine. (Bates - East Central)

4226-A2, A4, A6, A7, A8, B1, B4, D1, D3, E2, F2,
WASTE HANDLING AND DISPOSAL GUIDELINES FOR INDIANA DAIRYMEN

Purdue University Animal Waste Committee Publication Number ID-81, Cooperative Extension Service, Purdue University, 1972, 12 p. 3 fig., 3 tab.

Keywords: Waste management, Waste disposal, Indiana, Legal aspects, Dairy industry, Regulation, Design, Solid wastes, Liquid wastes, Waste storage, Pasture system, Drylot system, Covered system, Land disposal, Application rates, Water pollution, Odor control, Agricultural runoff.

The purpose of this publication is: (1) to acquaint the Indiana dairy farmer with present pollution laws and regulations that most directly affect him, and (2) to present waste handling and disposal guidelines that will help the dairyman determine how nearly he complies with these laws and regulations or how he might develop a system that will comply. The Indiana Stream Pollution Control Board and the Indiana Air Pollution Control Board have the authority to adopt and enforce rules and regulations concerning their respective types of pollution problems. Indiana's Confined Feeding Control Law supplements the Indiana Stream Pollution Control Law in attempting to prevent water pollution. It isnow against the law for anyone to start building a confined feedlot operation without approval by the Stream Pollution Control Board. The kind of waste handling system a dairyman should have, facilities needed, their capacities and design, and types of management practices depend, to a large extent, on the number of animals and how they are handled. Systems for handling dairy cattle usually fall into three broad categories -- pasture, drylot, and covered systems. Each of these is described and recommended grazing and housing intensities are given. Guidelines are given for design and management. Either solid manure handling systems, liquid manure handling systems, or partial treatment manure handling systems may be utilized in handling and storing wastes. Design recommendations are given for the various management methods utilized in each of these systems. Most dairy wastes are still disposed of on the land. Factors affecting land application rates, how acceptable land application rates may be determined, and precautions that should be taken when returning manure to the land are discussed. Suggestions for minimizing odor problems during disposal are given. (Rowe-East Central)

4227-A2, A4, A6, A7, A8, A10, B1, B2, B3, B4, C2, D1, D2, D3, E2, E3, E4, F2
WASTE HANDLING AND DISPOSAL GUIDELINES FOR INDIANA POULTRYMEN

Purdue University Animal Waste Committee Publication Number ID-82, Cooperative Extension Service, Purdue University, 1972, 13 p. 2 fig., 3 tab.

Keywords: Waste management, Waste disposal, Poultry wastes, Indiana, Legal aspects, Regulations, Water pollution, Odor, Liquid wastes, Solid wastes, Drying, Incineration, Digestion methods, Land application, Application rates, Flies, Wastewater disposal.

The purpose of this publication is to briefly explain the pollution laws and regulations that directly affect Indiana poultry producers and to provide waste handling and disposal guidelines that will prevent pollution problems. The Indiana Stream Pollution Control Board and the Indiana Air Pollution Control Board have the authority to control and prevent water and air pollution in the state of Indiana. Indiana's Confined Feeding Control Law supplements the Indiana Stream Pollution Control Law in attempting to prevent water pollution. It is now against the law for anyone to start building a confined feeding operation without approval by the Stream Pollution Control Board. The production system that a poultryman adopts depends largely on the kind of poultry he produces (broilers, layers, etc.). Manure production rates for the different kinds of birds are given. Solid manure handling systems include shallow pit system, deep pit system, litter system, and partial slotted-floor system. The shallow pit system may also be adapted to liquid handling, but it is not recommended for new housing because of: extra labor for frequent cleaning, greater volume of waste because of the extra water used for cleaning, pollution danger from disposing during the winter, and probable odors. Outdoor confinement rearing can be a source of pollution; therefore, proper management of these facilities is essential. Poultry confinement units are sources of odor and fly problems. Odor and fly control methods are discussed. Poultry wastes may be disposed by means of drying methods, incineration methods, digestion methods, or land application methods. Design recommendations are given for the various management and disposal methods that are discussed. Guidelines are given for returning poultry wastes to the land. Suggestions are given for minimizing odor during disposal. Suggestions are given for treating and disposing of wastewater. (Rowe-East Central)

4228-A2, A4, A6, A7, B1, B2, B3, B4, C2, D1, D3, E2, F2
WASTE HANDLING AND DISPOSAL GUIDELINES FOR INDIANA SWINE PRODUCERS

Purdue University Animal Waste Committee Publication Number ID-83, Cooperative Extension Service, Purdue University, 1972, 12 p. 2 fig., 2 tab.

Keywords: Waste management, Waste disposal, Swine wastes, Indiana, Legal aspects, Regulation, Water pollution, Liquid wastes, Solid wastes, Land application, Odor control, Housing, Agricultural runoff.

The purpose of this publication was to acquaint the Indiana swine producer with present pollution laws and regulations that most directly affect him and to present waste handling and disposal guidelines that will help the producer determine how nearly he complies with these laws and regulations or how he might develop a system that will comply. The Indiana Stream Pollution Control Board and the Indiana Air Pollution Control Board have the authority to control and prevent water and air pollution in the state of Indiana. Indiana's Confined Feeding Control Law supplements the Indiana Stream Pollution Control Law in attempting to prevent water pollution. It is now unlawful for anyone to start construction of a confined feeding operation without prior approval by the

Stream Pollution Control Board. The type of swine waste handling system used depends upon location, number of animals, and method of housing. Housing systems include pasture, drylot, and enclosed. Management recommendations are made for each of these types of systems. Drylot and enclosed systems of management call for waste handling and storage facilities that may be categorized as follows: (1) solid manure handling systems, (2) liquid manure handling systems, and (3) partial-treatment manure handling systems. Methods of waste handling which are utilized under each of these categories are described. Most swine producers still dispose of their swine manure by returning it to the land by surface application, surface application with immediate plowdown, or injection or knifing into the soil. Factors affecting land application are manure nitrogen content, loss of nitrogen by volatilization and denitrification before field application, type and management of crops to be grown, and the soil itself. Guidelines are given for determining acceptable application rates. Precautions are outlined which should be considered when applying wastes. Odor control techniques are given for minimizing odor during disposal. (Rowe-East Central)

4229-A11, B1
DESIGN CRITERIA FOR AIR CARGO SYSTEMS FOR SHEEP

Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland
B. H. Ashby, W. A. Bailey, J. J. Sushko III, W. G. Kindya
Transactions of the ASAE, V. 20, No. 1, p. 117-120, Jan.-Feb., 1977. 5 fig., 7 ref.

Keywords: Animal wastes, Sheep, Air transport, Design, Cargo systems, Load density, Mesh flooring, Performance

Two 48-hour test experiments were conducted in which sheep were subjected to partially simulated air transport conditions to obtain basic criteria for designing air cargo systems for sheep. Test No. 1 was conducted in August, 1975. Module temperatures ranged from 24 to 32°C during the test. One hundred and twenty open ewes averaging 116 lb. were removed from pasture. Sixty sheep were loaded in the bottom deck of the module. The remaining 60 sheep were held in a graveled lot for 24 hr. and then loaded in the second deck of the module for the remaining 24 hr. of the test. Water was available to the animals, but feed was withheld. Average load density was 2.7 ft^2/ sheep. For the second test, 77 open ewes averaging 110 lb. each were separated from the same flock. Immediately after removal from pasture, 20 sheep were penned in the bottom deck of the module; forty sheep were penned in the second deck, and 17 sheep were penned in the third deck. Load density averaged 2.8 ft^2/sheep. No water or feed was provided. Sheep from the bottom deck were released after 24 hr. The other sheep were released after 48 hr. All the sheep were examined by a veterinarian. Conclusions and recommendations were: (1) A 10-15 hr. pre-transit fasting is recommended to reduce waste production of sheep during air transit. (2) Water need not be provided for sheep during a 24 hr. transit period if extended temperatures above 32.5° are not encountered. (3) Group size of sheep in pens should be 40 or less. (4) Wire mesh flooring appears to be an excellent alternative to solid flooring with bedding, and it provides improved air circulation, slip resistance, and drop through waste removal. (5) Rounded surfaces for pen frame construction such as pipe or tubing should be used instead of I beam. (6) To facilitate loading and unloading, drive alleys and loading chutes should be well lighted and constructed to allow animal handlers easy accessibility to the sheep. (7) Highly reflective materials or sharp angled turns should be avoided in the construction of equipment for handling sheep. (Rowe-East Central)

4230-A6, B2, D3, F1
THE OXIDATION DITCH — A POSITIVE METHOD OF ODOR CONTROL

Department of Agricultural Engineering, University of Manitoba, Winnipeg, Canada
D. D. Schulte and E. J. Kroeker
Paper presented at Agricultural Engineering Conference Days, School of Agriculture, University of Manitoba, Winnipeg, Canada, Feb. 4-5, 1976, 9 p. 1 fig., 3 tab.

Keywords: Odor control, Waste treatment, Confinement pens, Oxidation ditch, Foaming, Ventilation, Economics.

The oxidation ditch offers a positive though somewhat expensive method of odor control to the livestock producer. It is best suited to use under slotted floors or cages in confined housing situations. Operational problems do exist with the oxidation ditch, but proper maintenance coupled with good management and an appreciation for the microbial nature of the treatment process can minimize these problems. Engineering advice should be sought before investing in this process. (Schulte-University of Manitoba)

4231-B1, C2, D3, E3, F1
ON METHANE PRODUCTION

Anonymous
Confinement, V. 2, No. 5, p. 11, May, 1977.

Keywords: Methane, Energy, Recycling, Anaerobic digesters, Economics.

The engineering and economic potential of anaerobic digestion was studied by Iowa Agricultural Experiment Station researchers. Operation of anaerobic digesters, energy use on farms, and the current cost-and-price relationships for farm inputs and products were evaluated. The analysis was geared to a 320-acre mixed crop and livestock farm in central Iowa which had a 50-sow farrow-to-finish confinement unit, a flush-flume building of 300-head capacity for beef feeding, and a cow-calf herd managed in an open lot and on pasture. It was calculated that 75 percent of the farm's electrical energy could be supplied by an engine-generator powered by methane produced from the farm's animal waste. In addition, the recovery of heat energy from the generator could supply a significant part of energy needed on an annual basis for grain drying and heating of the swine unit and farm house. Experiences with a pilot-scale digester have revealed that proper loading rates and effective mixing are extremely important for long-term, stable operation. Construction of an experimental 30-head beef confinement unit and 5000 gal. anaerobic digester should begin soon at the ISU Beef Nutrition Farm near Ames in hopes of answering many of the practical management questions involved in operating an anaerobic digester on farm-size scale. Although the economics of on-farm anaerobic digestion are not favorable under current conditions, further research to improve the technical operation of digester systems is believed to be important. Changes, such as further energy-supply reductions, significant increases in energy costs, rationing of some forms of energy, or more stringent pollution controls for livestock enterprises, could make anaerobic digestion a viable option for producers in the future. (Rowe-East Central)

4232-A11, B3, C2, E3
HEN EXCRETA COMPOSITION AND RUMEN PARAMETERS

University of Guelph, Guelph, Ontario, Canada
E. Evans and E. T. Moran, Jr.
Journal of Animal Science, V. 43, No. 1, p. 211, July, 1976.

Keywords: Feeds, Sheep, Refeeding, Dried poultry wastes, Rumen, Ammonia, Uric acid, Urea nitrogen, Plasma concentrations.

Rumen levels of ammonia (NH_3-N), uric acid (UAN) and urea nitrogen (UN) and plasma concentrations of urea nitrogen (BUN) were measured at 0, .5, 1.5, 2, 4, 6 and 8 hr, postprandially in adult male fistulated sheep fed low (trial 1) or high roughage (trial 2) rations. In each case supplemental nitrogen was provided by soybean meal, urea, and dried excreta from hens receiving a low (LPN-excreta) or high plane of nutrition (HPN-excreta) diet to determine the effects of nitrogen source on rumen degradation. Sheep were fed at the rate of 154 kcal DE/$kg^{.75}$ in both 4 X 4 latin square design trials. In trial 1, mean daily NH_3-N and UN concentrations were higher ($P<.05$) for urea and HPN-excreta than for soybean meal and LPN excreta diets. BUN levels were higher ($P<.05$) with the urea and lower ($P<.05$) with the soybean meal diets than from either source excreta. In trial 2, meal daily NH_3N and UN concentrations were elevated ($P<.05$) by urea and decreased ($P<.05$) with the soybean diets compared to the hen waste diets. BUN concentrations were higher ($P<.05$) with the urea obtained than with the other diets. In both trials, NH_3N and UN concentrations peaked ($P<.05$) at .5 hr post feeding with the urea diet as opposed to a gradual increase until 2 hr post feeding for the soybean meal, LPN- and HPN-excreta diets. Effects of rate of microbial UAN degradation on appearance patterns of UN and NH_3N in the rumen will be discussed in relation to nitrogen availability for microbial protein formation. (Copyright 1976-Journal of Animal Science) (Abstract only)

4233-A11, B3, C3, D3
STUDIES ON THE VIABILITY OF PATHOGENIC BACTERIA DURING SHORT-TIME-COMPOSTING OF POULTRY MANURE

S. Platz
Zentralblatt Fur Veterinarmedizin (Reihe B), V. 24, No. 1, p. 25-34, Jan., 1977. 1 fig., 2 tab., 41 ref.

Keywords: Poultry manure, Composting, Pathogenic bacteria, Temperature.

The survival of different pathogenic bacteria (*Salmonella typhimurium, S. pullorum, Escherichia coli, Proteus vulgaris, Pasteurella hemolytica, Past. multocida*, haemolytic *Micrococci*, haemolytic *Streptococci, Listeria monocytogenes Type I* and *Clostridium perfringens Type A*] during short-time-composting of poultry manure was studied. Except for *Listeria* the rising temperature was sufficient to eliminate the investigated vegetative forms of pathogenic bacteria after exposure to an average of 22 hours' composting process. In the case of direct infection of poultry manure, the athermic factors of composting, for example the alkalinisation of compost to pH 8.8, which were said to destroy the pathogenic agents, and which were found in the present examinations, are further hygienic safeguards. However, the inactivating effect of athermic factors, due to the accelerated progress of short-time-composting should not be overrated. With regard to *Clostridium perfringens type A*, neither the rising temperature nor athermic factors of the composting process were sufficient to destroy these pathogens. Possibilities for inactivation of spore-formers by means of influencing the course of self-heating are discussed. (Copyright 1977 - Zentralblatt Fur Veterinarmedizin)

4234-A11, B3, E3
DRIED POULTRY WASTE AS A SUPPLEMENT FOR BEEF CATTLE

University of Missouri, Columbia, Missouri
M. R. Dethrow, J. L. Clark, J. M. Vandepopuliere, and D. P. Hutcheson
Journal of Animal Science, V. 43, No. 1, p. 210, July, 1976.

Keywords: Dried poultry wastes, Refeeding, Cattle, Digestibility, Feed supplements.

Five steer calves were assigned to a 5 X 5 latin square design metabolism trial to study the value of dried poultry waste (DPW). The cattle were fed corn silage *ad libitum* and allowed to adjust to a constant intake. The following supplements were fed per animal daily: 1) .04 kg dicalcium phosphate and T-M salt; 2) .45 kg SBM+.04 kg dicalcium phosphate and T-M salt; 3) .23 kg SBM and .38 kg DPW; 4) .75 kg DPW; 5) 1.6 kg DPW. The animals were fed twice daily and given an injection of vitamins A and D at the beginning of the trial. Feces and urine were collected daily. When no SBM was fed there was a reduction in the digestibility of dry matter, crude fat, NFE and nitrogen. The apparent dry matter digestibility values for the total ration were 74.2, 77.7, 75.5, 70.1 and 70.9, respectively, for the five supplements. The apparent digestibilities for NFE and nitrogen in the total ration were 79.2, 62.0; 82.1, 70.4; 80.4, 65.7; 75.5, 57.5; 74.0, 60.6, respectively, for the five supplements. No significant differences were observed among the supplements for crude fiber digestibility. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4235-A11, B1, E3
RECYCLING OF SWINE MANURE BY SELECTED FISHES

University of Illinois, Urbana, Illinois
D. H. Buck, R. J. Baur, and C. R. Rose
Journal of Animal Science, V. 43, No. 1, p. 210, July, 1976.

Keywords: Refeeding, Swine wastes, Fish, Performance, Water quality.

This is believed to have been the first attempt in North America to utilize certain Asian cultures and techniques in the solution of such problems as animal waste management, pollution control, and the production of protein. Two small Illinois ponds of similar size received nearly identical stockings of fish (four Asiatic species), but differing amounts of swine manure. Pond 11 received the total wastes from five growing pigs (about 39 pigs/ha of water area), pond 12 received the wastes from eight pigs (66 pigs/ha). Two consecutive lots of pigs were fattened during the experiment. Water levels were lowered at mid-season to improve natural circulation, but conditions were otherwise static, with no artificial circulation or aeration. Over a fish growing period of about 170 days (May to Oct.) the net increments in fish biomass were at the rates of 2971 kg/ha in pond 11, and 3834 kg/ha in pond 12. The high production of fish was attributed to (1) the high quality of the swine rations, (2) a fortuitous choice of a fish stocking ratio, and (3) effective water level management. A beneficial influence by the fish population on water quality was indicated by continuously adequate levels of dissolved oxygen, and final BODs (BOD$_5$ in the range of 8 to 12 mg/1. (Copyright 1976-Journal of Animal Science) (Abstract only)

4236-A11, B3, C2, E3
HEN EXCRETA COMPOSITION AND METABOLISM BY SHEEP

University of Guelph, Guelph, Ontario, Canada
E. Evans and E. T. Moran, Jr.
Journal of Animal Science, V. 43, No. 1, p. 210-211, July, 1976.

Keywords: Dried poultry manure, Refeeding, Sheep, Metabolism, Nutrients, Nitrogen, Digestibility.

Nutrient digestibilities and nitrogen retensions were determined in two 4 X 4 latin square design trials conducted with ram lambs fed diets in which half of the crude protein (CP) equivalent was provided by soybean meal, urea, and dried excreta from hens receiving a low (LPN excreta) or a high plane of nutrition (NPU-excreta) diet. In trial 1, diets were formulated to contain 2.9 Mcal DE/kg, 12 percent CP and 14 percent acid detergent fiber (ADF). In trial 2 the same test protein sources were compared in diets containing 2.2 Mcal DE/kg, 12 percent CP and 25 percent ADF. All diets were fed at the rate of 210 Kcal DE/kg$^{.75}$. Within each trial, energy CP, and DM digestibilities were higher (P<.05) from diets containing soybean meal and urea than from diets containing LPN- and HPN-excreta while fiber digestibility was not affected. Mean nitrogen retensions for trial 1 were 31.6, 13.4, 19.4 and 26.6 percent and for trial 2 were 20.1, 10.9, 14.1, and 19.1 percent for the soybean meal, urea, LPH-excreta and HPN-excreta diets, respectively. Components of the nitrogen fraction of the two sources of excreta differed largely by their uric acid contribution. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4237-B2, B5, C2, E2
VALUE OF LIQUID CATTLE WASTE TO ESTABLISHED GRASSES

University of Georgia College of Agriculture, Coastal Plain Experiment Station, Tifton, Georgia
G. L. Newton, W. H. Marchant, P. R. Utley, and W. C. McCormick
Journal of Animal Science, V. 43, No. 1, p. 211, July, 1976.

Keywords: Liquid wastes, Cattle wastes, Land application, Fertilizers, Chemical properties, Pasture land management.

Six pastures (.81 ha each) with established sods of either Coastal bermudagrass (three pastures) or Pensacola bermudagrass (three pastures) received three fertilizer treatments. The treatments, applied to one pasture of either grass, were 84 kg N per hectare from liquid manure in March and 84 kg N per hectare from commercial fertilizer in June (MCF) and 168 kg N per hectare from liquid manure in March (M). The manure used was waste from deep pits located beneath a totally slotted floor beef cattle feedlot. Five steers (average weight 183 kg) were allotted to each pasture in April. These steers were weighed at 28-day intervals during the 168-day grazing trial. The animals were fenced out of an area (9.3 m^2) in each pasture which was clipped periodically to estimate yield and provide samples for chemical analysis. Pastures receiving treatment MCF and M tended to produce greater spring growth and greater (P <.05) steer gains for the first 28-day period. Pasture dry matter yields and steer gains were 13.17 MG/ha and 534 kg/ha, 12.01 MT/ha and 60.7 kg/ha and 12.40 MT/ha and 575 kg/ha for the CF, MCF and M treatments, respectively. When N recovered in forage is examined in relation to N applied, it was observed that Coastal bermudagrass utilized manure N approximately 85 percent as effectively as it utilized ammonium nitrate N while Pensacola behiagrass utilized manure N approximately 54 percent as effectively as ammonium nitrate N. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4238-C2
DETERMINATION OF VANILMANDELIC ACID IN PIG URINE AND CHICKEN FECES BY GAS-LIQUID CHROMATOGRAPHY

Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1
A. Lun, R. R. Hacker, R. G. Brown, and J. F. Hurnik
Analytical Biochemistry, V. 73, No. 2, p. 267-273, 1976. 4 fig., 2 tab., 30 ref.

Keywords: Venilmandelic acid, Swine urine, Poultry feces, Gas-liquid chromatography, Sampling.

A gas chromatography method for the determination of free and bound venilmandelic acid (VMA) in pig urine and chicken feces has been developed. The method consisted of extraction of the free or bound acids by ethyl acetate under acidic conditions. The ethyl acetate extracts were dried under nitrogen, followed by complete silylation of the phenolic and carboxylic acid groups with BSA (N,O)bis (trimethylsilyl) acetamid. The solution was distilled at 180°C in a sealed glass tube after which the sample was injected on a stainless steel column (6 ft X .125 in. o.d.) containing 4 percent SE-30 on 80/100 mesh chromosorb GHP. The recovery of the urinary VMA was 82 percent, and the fecal VMA was 84 percent through the outlined procedures. Pigs ranging in age from 8 to 12 weeks were found to excrete 2-8 mg urinary VMA/24 hr with no significant difference between the free and bound. Commercial laying hens excreted bound VMA in a range of 1-5 mg/24 hr with no significant difference between the free and bound. Commercial laying hens excreted bound VMA in a range of 1-5 mg/24 hr with a F/B ratio of 1:3. (Copyright 1976 - Analytical Biochemistry)

4239-A6, A10, A11, B3, C2, E3, F1

SLAT-SCRAPE RECAPTURES RATION NUTRIENTS FOR REFEEDING MANURE

Staff Editor, Feedlot Management
G. Lamp
Feedlot Management, V. 19, No. 4, p. 12-14, April, 1977. 3 fig.

Keywords: Cattle manure, Ensiling, Wastelage, Performance, Cattle, Economics, Slat-scrape system, Odor control, Fly control, Nutrients.

Willard Baxter, manager of Baptist Children's Home feedlot, ensiles waste from his feedlot and refeeds it to cattle following a 12-15 day fermentation process. Manure straight from the feedlot is mixed at the following ratio: 45 percent cracked corn, 15 percent corn silage, and 40 percent manure for this ensiling process. The resulting wastelage is basically 70 percent TDN and about 12 percent protein. Hay, corn silage, peanut and cottonseed hulls are the primary components for roughage. Sometimes, for adequate ensiling, even a poor quality hay is added for enough digestible fiber to drop the moisture level of the ration to 50-51 percent. Since ensiling, Baxter has had much less problem with flies and odor. Baxter professes the ensiling and fermenting process to be the cheapest practice known to man for feed processing. In 1975, Baxter built the 200-head cold confinement building. The original cost of the unit was about $800-850 per head. (Rowe-East Central)

4240-B2, B3, B4, C2, E2

MANURE SYSTEMS PLANNING DATA

Anonymous
Doane's Agricultural Report, V. 35, No. 45, p. 5-6, Nov. 10, 1972. 10 tab.

Keywords: Livestock wastes, Waste management, Waste storage, Waste disposal, Lagoons, Holding ponds, Settling basins, Liquid wastes, Solid wastes, Nutrients, Nitrogen, Phosphorus, Potassium, Land spreading.

Guidelines are given for planning manure disposal facilities. To determine the manure storage requirements, the manure produced per day is multiplied by the number of days in the required storage period. Then that figure is multiplied by the number of animals. This shows the total amount of manure that will be present at the end of the holding period. For efficient pumping of liquid manure, the moisture content should be around 90 percent. To irrigate with liquid wastes, moisture content should be around 95 percent. The manure lagoon should be large enough to provide sufficient water in which bacteria can decompose the waste material. The quantity of water varies with different kinds of livestock wastes. Sludge will accumulate in the bottom of a lagoon over a period of time. A settling pond or basin before the lagoon reduces loading and sludge buildup. A holding pond, or a combination of a settling basin and a holding pond should be used for liquid runoff from solid manure. The amount of nutrients retained in manure depends on how the manure is handled. Liquid manure systems retain more nutrients. Leaching and runoff can cause heavy losses to occur from solid waste systems. The land area necessary for final spreading or dispersion of manure will vary. Current Illinois recommendations for maximum annual application rates from liquid manure holding pits are: cattle–20-30 tons/acre; hogs–10-15 tons/acre; and poultry–4-8 tons/acre. (Rowe-East Central)

4241-B1, B5, C2, D3, E2, E3

THE WEDDING OF CLUCK AND MOO

Anonymous
Calf News, V. 14, No. 12, p. 28-29, Dec., 1976. 6 fig.

Keywords: Management, Poultry, Cattle, Confinement pens, Recycling, Refeeding, Methane, Reclamation, Algae.

Hans Lengers, president of Dew Fresh Eggs Corporation of Bethune, South Carolina, is planning the combining of an ultramodern fireproof facility for housing 1.2 million layers and a 30,000-head slotted floor confinement operation (designed and built by Corral Industries, Phoenix, Arizona). The first units for 10,000 head of cattle have been built. The 10,000-head facility includes a compact work area, good slope, and a completely automated scraper moving the manure to the processing area every hour during the day and every 3 hours during the night. There is an ammonia control system working in conjunction with the scraper which controls the pH in the pits and building. The ultimate plan calls for recycling poultry manure in 3 ways – for reclamation of 2,600 acres of sandy soil for crop production; for production of methane gas which will be sold to a local gas company; and for supplementing cattle feed. Another of Lengers' idea for the future is to grow algae from the residue of the methane production. Then, once the CO_2 is allowed to disappear, the algae may be fed to fish, cattle, or even humans. (Albertson-East Central)

4242-A4, B2, C3, D2

FEASIBILITY OF CHLORINATING FEEDLOT RUNOFF TO MEET BACTERIAL WATER QUALITY STANDARDS

Agricultural Engineering Department, Water Resources Research Center, University of Maryland, College Park, Maryland 20742
J. A. Merkel
Technical Report No. 37, Water Resources Research Center, University of Maryland, 1975, 15 p. 5 tab.

Keywords: Agricultural runoff, Feedlots, Water pollution, Wastewater treatment, Water quality, Fecal coliforms, Loading rates, Salinity, Chlorination, pH, Dissolved oxygen, Temperature, Design.

A study was conducted to determine the parameters required for effectively treating effluent from livestock operations before discharging it into streams. The experiment was organized to determine how population kinetics of bacteria was affected by varying pertinent environmental parameters. Tests were conducted by varying one environmental parameter at a time while holding the remaining variables constant. The variable parameters were: (1) type and amount of loading, (2) salinity, (3) pH, (4) dissolved oxygen, and (5) temperature. The statistical design selected for analyzing the data was a Model I nested ANOV. Study results indicated that salinity control could be used as an effective means of reducing the coliform count of runoff contaminated with livestock waters. It was determined that a system that would be feasible for controlling the quality of the runoff leaving a farmstead would be a retention pond coupled with a device for salting the pond effluent. The pond itself could be designed to accomodate the runoff for an average rainfall based on a one year recurrence interval. The excess runoff could be channeled into a trap or bin containing a soluble salt that would increase the salinity in accordance with design conditions. (Rowe-East Central)

4243-B1, B2, B3, B5, C1, C2, D1, D2, D3, E2, E3, F1

FEEDLOT MANURE AS AN ENERGY SOURCE

Agricultural Engineering Department, Texas A&M University, College Station, Texas 77843
J. M. Sweeten, D. L. Reddell, and B. R. Stewart
Paper presented at the 1974 Texas Section Meeting, American Society of Agricultural Engineers, Abilene, Texas, Oct. 4-5, 1974, 21 p. 2 fig., 6 tab., 32 ref.

Keywords: Feedlot manure, Energy, Economics, Recycling, Fertilizers, Refeeding, Fuels, Anhydrous ammonia, Land disposal.

A comparison was made of the energy savings available from Texas feedlot manure utilized for: (1) fertilizer, (2) roughage substitute in feedlot rations, (3) fuel, and (4) substitute for natural gas in anhydrous ammonia production. Study results indicated that replacement of commercial fertilizer by manure could save a total of 1.8×10^{12} BTU's of energy per year. Refeeding 5 percent manure could save 6.5 million BTU's per ton of manure. Energy requirements for air pollution control systems and moisture evaporation would permit only 5.3 million BTU's per ton (dry solids) of the possible 12.6 million BTU's per ton (dry solids) to be released as usable heat energy resulting from direct combustion. Gasification of manure through partial oxidation would result in production of anhydrous ammonia with far lower energy consumption than is now being realized. At the present time, energy savings would exceed 10 million BTU's per ton of dry solids. While refeeding appears to offer the maximum potential for energy savings, lack of market for this refeeding product is a deterrent to this type of recycling. Land disposal for improved crop production is still the most viable solution. While thermo-chemical processing of feedlot manure could result in a larger energy savings than is now possible, lack of large scale centralization of Texas feedlots make this alternative less promising. (Rowe-East Central)

4244-B1, C1, C2, C3, D2, D3, E3

FERMENTATION OF POULTRY MANURE FOR POULTRY DIETS

State Institute of Agricultural Chemistry, Laboratory of Microbiology, Liisankatu 8 G, 00170 Hensinki 17, Finland
A. T. Vuori and J. M. Nasi
British Poultry Science, V. 18, No. 3, p. 257-264, May, 1977. 4 tab., 11 ref.

Keywords: Poultry wastes, Fermentation, Refeeding, Poultry, Uric acid, Cell yield, Bacteria, Yeasts.

In an attempt to increase its value for poultry diets, the fermentation of poultry manure was studied. Microbial strains for the efficient elimination of uric acid were isolated. In attempts to increase cell yield, suitable, cheap carbon sources (methanol, glycerol, glucose) were tested. These criteria were used to study the 41 bacterial and 8 yeast strains which were the most prolific on slants and which were isolated from experiments with a shaker. A strain was selected for experimentation with a fermentor. Fermentor experiments were done on a laboratory scale (10 1) and in a non-sterile semicontinuous system (150 1) cell mass production being similar in both systems. Study results are given in tables. (Copyright 1977 - British Poultry Science; Rowe, ed.-East Central)

4245-B1, C1, D1
SIMULATION OF IN-HOUSE DRYING OF CHICKEN EXCRETA

G. D. Wells
Ph. D. Thesis, Department of Agricultural Engineering, Michigan State University, 1972, 138 p. 18 fig., 16 tab., 44 ref.

Keywords: Poultry manure, Drying rates, Mathematical models.

This study was undertaken to develop drying rate equations for deposited chicken excreta. Study objectives were to: (1) determine drying rates for the initial drying phases by obtaining sufficient experimental data, (2) evaluate drying rates as influenced by environmental, geometrical and excreta conditions, (3) determine the duration of time in which each rate holds and how much water is removed during each period, and (4) develop a semi-empirical mathematical model to predict drying rates in the initial phases. Laboratory drying tests were conducted utilizing poultry excreta samples (10 cm wide by 10 cm long) of 3 thicknesses (0.32, 0.64, 0.96 cm). Two drying rate periods were observed. As long as surfaces were saturated, constant rate drying took place. This constant rate period was followed by an extended period of falling rate drying. The constant drying rate was found to be a function of free stream velocity, wet-bulb depression and ambient air temperature as it affects vapor pressure at the saturated surfaces. Process variables of increased surface area and conducted heat source also increased the drying rate. The constant drying rate was predicted on the basis of surface film resistance and concentration gradient terms. More than half of the removable moisture evaporated at a constant rate. The rate of change in moisture during the falling rate drying period was roughly proportional to the removable moisture remaining. The proportionality constant was estimated as a function of the constant drying rate and the sample thickness. Free stream conditions were found to be of major importance throughout both the constant and falling rate drying periods. Most of the non-hygroscopic water appeared to move to the surface in liquid form to be evaporated there. Comparison of experimental drying rates to in-house drying data indicated that in-house drying rates could be predicted if a measure of the mean boundary layer thickness and area of wet surface was approximated. (Rowe-East Central)

4246-A8, A9, C2, E2
EFFECT OF SIMAZINE AND ATRAZINE ON THE MINERALIZATION OF FERTILIZER AND MANURE NITROGEN

Nuclear Research Laboratory, Indian Agricultural Research Institute, New Delhi, India
O. P. Joshi, M. S. Sachdev, K. L. Sahrawat, and B. N. Kohli
Plant and Soil, V. 44, No. 2, p. 367-375, 1976. 12 fig., 3 tab., 6 ref

Keywords: Herbicides, Fertilizers, Manure, Soil chemical properties, Ammonia, Nitrates, Atrazine, Simazine, Soil investigations.

Simazine and atrazine herbicides were tested for their effects on mineralization of urea and sludge manure nitrogen in laboratory experiments. Simazine and atrazine were applied at four levels (0.5 1.0, 1.5 and 2.0 kg/ha). It was found that the herbicides stimulated the production of ammoniacal and nitrate nitrogen. No specific trend was noted in nitrate production by increasing the levels of the herbicides. Urea nitrogen mineralized faster than the sludge nitrogen or its combination with urea. With respect to the total amount of ammoniacal nitrate nitrogen produced, the results in descending order were: Urea >Sludge+Urea>Sludge>No Nitrogen. (Rowe - East Central)

4247-A11, B1, C3
TOXIGENIC FUNGI FROM POULTRY FEED AND LITTER

U.S. Department of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, Division of Microbiology, Cincinnati, Ohio 45226
J Lovett
Poultry Science. V. 51, p. 309-313, 1972. 3 tab., 21 ref.

Keywords: Fungi, Poultry, Litters, Feeds, Toxins.

Fungi isolated from feed and litter of two Ohio poultry farms were screened for toxin production. Fourteen-day-slant cultures were used to inoculate neopeptone dextrose, Czapek-Dox, and Mycological broth media. Four-day chick embryos were inoculated with 0.2 ml. of culture filtrate via the air cell. Embryo death at 9 days was used as the toxicity indicator. Those fungi found toxigenic in one or more media were *Aspergillus chevalieri* (one), *A. fumigatus* (one), *A. terreus* (two), *Penicillium cyclopium* (five), *P. patulum* (two), and one each *Fusarium* and *Scopulariopsis* sp. Of those isolates screened 13 percent were found toxigenic. (Copyright 1972-Poultry Science)

4248-A11, B3, C1, C2, C3, E3
CHEMICAL AND BACTERIOLOGICAL COMPOSITION AND THE METABOLISABLE ENERGY VALUE OF EIGHT SAMPLES OF DRIED POULTRY WASTE PRODUCED IN THE UNITED KINGDOM

D. W. F. Shannon, R. Blair and D. J. W. Lee
World's Poultry Science Journal, V. 29, p. 157, 1973.

Keywords: Dried poultry wastes, Biological properties, Chemical properties, Physical properties, Bacteria, Energy, United Kingdom, Autoclaving, Nutrients.

Chemical and bacteriological analyses were carried out on eight samples of dried poultry waste (DPW) produced at different locations in the UK to estimate the variation in their potential nutritive value for poultry. The samples were all obtained from caged layers given medium-energy diets. The metabolisable energy (ME) values of the samples were determined with light hybrid hens and the effect of autoclaving on the ME value of one of the samples was measured. The composition of the DPW samples varied widely. Dry matter (DM) varied from 82.3 to 96.1 percent. On a DM basis, nitrogen varied from 2.9 to 6.2 percent; ash from 20.7 to 49.4 percent; calcium from 5.1 to 15.1 percent; phosphorus from 1.9 to 3.4 percent; available carbohydrate from 2.7 to 13.9 percent; and uric acid from 2.3 to 11.4 percent; the faecal protein content (10.1 to 14.8 percent) was much less variable than that of the nitrogen. Trace mineral contents also varied widely but with the exception of magnesium the mean levels of those elements measured were considerably lower than the levels considered to be toxic to the immature chick. Bacteriologically none of the samples was considered to be hazardous. The classical ME values of the samples varied from 0.84 to 1.27 kcal/g DM. Autoclaving did not significantly affect the ME value and the mean ME of all samples was 0.97 kcal/g DM. The mean losses of organic and dry matter on feeding the DPW samples were 18.6 and 24.4 percent. It is concluded that DPW has some food value for poultry and that it may be usefully included in poultry diets where dietary energy concentration is not important. (Copyright 1973-World's Poultry Science Journal) (Abstract only)

4249-A11, B3, D2, E3
THE GROWTH OF BROILER CHICKENS FED LOW-PROTEIN DIETS CONTAINING TRIAMMONIUM CITRATE, DIAMMONIUM HYDROGEN CITRATE AND AUTOCLAVED DRIED POULTRY MANURE

Agricultural Research Council's Poultry Research Centre, King's Buildings, West Mains Road, Edinburgh EH9 3FS, Scotland
J. V. McNab, D. J. W. Lee, and D. W. F. Shannon
British Poultry Science, V. 13, p. 357-364, 1972. 6 tab., 15 ref.

Keywords: Dried poultry manure, Autoclaving, Broilers, Refeeding, Performance.

Three experiments were carried out using male broiler chicks from 1 to 3 weeks of age. The birds were housed in individual metabolism cages at 1 week of age, having previously been in tiered brooders. In experiment I, 36 birds were offered one of six experimental diets based on glucose- and cellulose-diluted commercial broiler mash. The six diets were supplemented with graded levels of triammonium citrate (TAC) at the expense of cellulose such that diet 1B contained no TAC and diet IF contained 6.4 percent TAC. In experiment 2, 72 birds were offered one of six diets, similar to those used in experiment I with the exception that they were supplemented with graded levels of diammonium hydrogen citrate (DAHC). In experiment 3, 72 birds were offered one of six diets which were based on the same diluted broiler mash but which had been supplemented with graded levels of autoclaved dried poultry manure (ADPM) at the expense of glucose. Diet 3B contained no ADPM whereas diet 3F contained 20 percent ADPM. All birds were weighed at 2 and 3 weeks of age and their food consumptions over these periods were recorded. Their growth was compared with that of birds fed the undiluted commercial broiler food. All birds of experiment I (TAC-supplemented diets) and experiment 2 (DAHC-supplemented diets) showed significantly poorer growth rates than the control birds. However, birds of experiment 3 (ADPM-supplemented diets) grew as well as the control birds. (Copyright 1972-British Poultry Science)

4250-A8, C2, E2
SOME FACTORS TO CONSIDER IN USING ANIMAL MANURES FOR FERTILIZER

Extension Vegetable Specialist, University of California, Parlier, California
K. B. Tyler
Proceedings of the California Plant and Soil Conference, p. 41, 1973.

Keywords: Poultry manure, Feedlot manure, Soils, Nutrients, Land application, Potassium, Phosphorus, Nitrogen, Mineralization.

Using 3 California soils to which either poultry or feedlot manures had been added, a series of incubation experiments were conducted to better understand the availability of plant nutrients in manures. After application, mixing, and moistening the soil-manure samples, they were incubated for various time periods under conditions of temperature and aeration favorable for rapid decomposition of the manures. Samples were removed periodically from the incubation chambers, extracted and analyzed to determine their concentrations of available nutrients. Experimental results indicated that the availability of plant nutrients in manures varies considerably with soil type, kind of manure, and nutrient element in question. Potassium, which was high in feedlot and low in poultry manure, was about 80 percent available immediately after the manures had been applied. However, additional potassium release was very slow. About 25 percent of the total phosphorus in poultry manure and about 60 percent of the total phosphorus in feedlot manure was immediately available. Further releases of phosphorus were slow. The availability of nitrogen from manures was extremely low initially -- about 8 percent of the total nitrogen in poultry manure and 4 percent of the total nitrogen in feedlot manure. Release of nitrogen from poultry manure proceeded rapidly. Nearly 40 percent had become available after 12 weeks and about 50 percent after 36 weeks. Less than 1/3 of the total nitrogen of feedlot manure had been mineralized after 36 weeks of incubation. (Albertson - East Central)

4251-A4, A5, A6, A8, B1, C2, E2, F2
DESIGN CRITERIA FOR FIELD APPLICATION OF LIVESTOCK WASTE

Illinois Environmental Protection Agency
Technical Policy WPC-2, Design Criteria for Field Application of Livestock Waste, Illinois Environmental Protection Agency, April 15, 1976, 4 p. 4 tab.

Keywords: Livestock wastes, Land application, Illinois, Guidelines, Regulation, Pollution control, Nutrients, Nitrogen, Phosphorus, Crop response, Slopes, Soil injection.

Livestock waste application guidelines were adopted pursuant to Rule 104 (e) of Chapter 5: Livestock Waste, Illinois Pollution Control Board Rules and Regulations. Approximate expected quantities of total manure, nitrogen, phosphorus and potassium are listed for beef cattle, dairy cattle, swine, and poultry. Approximate nutrient content of wastes from various management systems, approximate net yield of nitrogen for various waste management systems, and agronomic fertilization rates for various Illinois crops are also listed. Livestock waste application should not exceed the agronomic nitrogen rate, which is defined as the annual application rate of nitrogen that can be expected to be required for a reasonable anticipated crop yield. Surface application may be used when the land slope is no greater than 5 percent or when the yearly average soil loss is less than 5 tons/acre. Injection or surface application with immediate incorporation should be used if land slope is greater than 5 percent. Livestock waste should not be applied within 200 feet of surface water. Waste should not be applied within 150 feet of any water well. Livestock waste should not be applied in a 10 year flood plain unless the injection or incorporation method of application is used. Waste application on frozen or snow-covered land should be avoided, if possible. Livestock waste should not be applied during a rainfall or to a saturated soil. Creation of odors during waste management should be minimized. (Rowe-East Central)

4252-A4, B1, B4, E2, F2
LIVESTOCK WASTE REGULATIONS. CHAPTER 5: AGRICULTURE RELATED POLLUTION

Illinois Environmental Protection Agency. Pollution Control Board
Livestock Waste Regulations, Chapter 5: Agriculture Related Pollution, Illinois Environmental Protection Agency, Pollution Control Board, Aug. 29, 1974, as amended Sept. 5, 1974, 8 p.

Keywords: Livestock wastes, Regulation, Feedlots, Confinement pens, Location, Waste storage, Land application, Permits, Legal aspects, Fish, Aquatic animals, Irrigation.

Chapter 5, Section 1 of the Illinois Pollution Control Board's Livestock Waste Regulations provides rules and regulations for agriculture-related pollution in relation to livestock wastes. Part I deals with general provisions such as: authority, policy, definitions, livestock management facility and livestock waste-handling facility operations, adoption of design and maintenance criteria, and inspections and disease prevention. Part II gives details on the various permits required for different types of operations and operators, the various types of applications which should be made, two standards for issuance, duration of permits, issuance and conditions of permits, appeals from conditions in permits, defenses, and authority to modify or terminate permits. Part III deals with other agricultural and silvicultural activities such as: fish and aquatic animal production, facilities, and irrigation activities. Part IV gives the details of the implementation program such as the compliance dates and severability. (Albertson-East Central)

4253-B3, C2, D1, E3, F1, F2
CATTLE FEEDING GAINS REPORTED GOOD ON MISSISSIPPI COMPANY'S POULTRY WASTE

Feedstuffs Southeastern Correspondent
R. H. Brown
Feedstuffs, V. 49, No. 22, p. 25, May 30, 1977

Keywords: Poultry wastes, Refeeding, Cattle, Economics Legal aspects, Design, Waste treatment.

Purnell's Pride, a Mississippi poultry company producing dried poultry waste as a feed commodity, reports that cattlemen are obtaining daily gains of 1.75 to 2.9 lb. Purnell's Pride produces three different products--range cubes, pure dried poultry waste, and a range meal. The range meal is the best seller even though it is the most expensive. Since it contains 25 percent salt, it limits intake. The cattlemen can place the range meal in a covered feeder on the range, which eliminates daily feeding. This company offers the products at a relatively low price to get the buyers interested in using them. The amount of waste from 200,000 hens is 140 tons a week, which results in 30 tons of finished product after drying. To date, Purnell's Pride is the only company selling poultry waste in Mississippi, but they don't take advantage of the situation. The state regulates their business by checking the material quarterly for salmonella, myotoxins, metals, medicants and pesticides, from which they have had no problems. (Hudson-East Central)

4254-B3, C3, D1
EFFECT OF DRYING TEMPERATURE AND LENGTH OF DRYING TIME ON SURVIVAL OF MICROORGANISMS IN TURKEY LITTER

Poultry Science Department, Clemson University, Rm. 137 P & AS Bldg., Clemson, South Carolina 29631
D. L. Cross, D. S. Triche, and J. W. Dick
Poultry Science, V. 53, p. 1915, 1974.

Keywords: Litters, Turkeys, Drying, Microorganisms, Temperature.

The effect of drying temperature and length of drying time on certain microorganisms in turkey litter was evaluated. A completely randomized design with a factorial arrangement of treatments was utilized. Each treatment and time combination was replicated 5 times. The drying temperatures were: 22, 150, 200, 250°C. The length of the drying times was 1, 2, and 3 hours. Total viable bacterial counts were determined after growth on nutrient agar for 24 hours. Selective organisms were determined following growth on SS agar plates for 24 or 48 hours. Gram-negative organisms were determined on E.M.B. agar after incubation for 24 or 48 hours. Anaerobes were determined in thioglycollate broth. The total viable counts (organisms/gm of litter) at 22, 150, 200 and 250°C., irrespective of length of drying time, were 4.6 x 10 , 4.5 x 10 , 7.4 x 10 , and 4.6 x 10 , respectively. Total viable counts (organisms/gm of litter) for litter samples dried for 1, 2, and 3 hours, irrespective of drying temperature, were 2.2 x 10 , 1.1 x 10 and 2.5 x 10 , respectively. Selection organisms from SS agar were present at 22°C. These organisms were not detected at the higher drying temperatures and drying times. Viability of Gram-negative organisms was destroyed after drying for 3 hours at 150°C. Viability of anaerobes was arrested by drying at 200°C. for 1 hour. (Copyright 1974-Poultry Science) (Abstract only)

4255-A11, B3, C2, E3

BROILER WASTES: GOOD PROTEIN SOURCE

Anonymous
Progressive Farmer, V. 92, No. 7, p. 88, July, 1977.

Keywords: Refeeding, Poultry wastes, Cattle, Performance, Nutrients.

A two-phase research study done at the Universitv of Georgia by Dr. A. E. Cullison and Mike Dzimianski shows that, as a supplement to Coastal bermuda-grass hay, pellets containing 75 percent broiler wastes and costing about $40/ton are just as valuable for rate of gain as a commercial protein supplement that costs $125/ton. In the first part of the study 2 groups of steers were fed 2 and 4 pounds of pellets daily, along with 10.5 pounds of Coastal bermuda-grass hay. The average daily weight gain was 1/2 and 3/4 pounds respectively. In the second phase, groups of steers were fed according to five different treatments: (1) a control group, (2) 25 percent broiler wastes and 75 percent ground shelled corn, (3) 50 percent broiler waste and 50 percent corn, (4) 75 percent broiler wastes and 25 percent corn, and (5) 25 percent dried layer wastes and 75 percent corn. All steers received limited straw. Group 2 had the best performance over the 138 day finishing period. They gained an average of 2.9 pounds/day -- the same rate as the control group. The cattle didn't seem to like the taste but would eat it when mixed with more palatable feeds. The researchers concluded that poultry waste is a valuable source of protein, calcium, phosphorus, and roughage. (Bates-ECU)

4256-A8, B5, C2, E2

SOIL PRODUCTIVITY IN RELATION TO HIGH LOADING RATES WITH MANURE

Soil Scientist, Agricultural Research Service, U.S. Department of Agriculture, Imperial Valley Conservation Research Center, Brawley, California
B. Meek
Proceedings of the California Plant and Soil Conference, p. 42, 1973.

Keywords: Application rates, Manure, Land application, Salinity, Ammonia toxicity.

In the past, manure has been used at rates of 5-20 tons/acre; however, experiments show that manure may be used at rates of up to 100 tons/acre before there is a yield reduction. High loading rates of manure cause problems with salinity and ammonia toxicity which may limit crop production. The salt content of manure is variable according to the ration which is fed. The salinity problem can be alleviated to a certain extent by applying one or two irrigations before planting. Ammonia toxicity may be alleviated by allowing the manure to partially decompose before planting. Advantages of applying manure at high rates are increased crop growth and earlier maturity. With proper management, it should be possible to apply manure at high rates without a reduction in soil productivity. (Albertson-East Central)

4257-A11, B3, C2, D1, E3, F1

IOWA FARMERS FEED DRIED POULTRY WASTE TO CATTLE

Al Morrow
Wallaces Farmer, V. 102, No. 12, p. 36, June 25, 1977. 1 fig.

Keywords: Dried poultry wastes, Refeeding, Beef cattle, Dairy cattle, Nutrients, Performance, Economics.

A poultry waste refining plant called RC Drying Inc. is now operating in Osage, Iowa. Partners in the new venture are Delbert and Dick Davidson and the Fly-Cross Chick Company, who supplies the poultry waste. An alfalfa dryer has been converted to process the waste. The dried product contains about 26 percent protein and is high in calcium and phosphorus. Minerals, vitamins, molasses and flavors are added to produce either a beef or dairy cattle supplement. The dried poultry waste (DPW) costs about half the present price of soybean oil meal. A handful of Bremer county farmers have been feeding the DPW since the Davidsons started marketing it one and one-half years ago. They concur with researchers claims that DPW can replace more expensive protein in the diet of ruminants. An initial problem that most farmers have encountered is acceptance of the poultry waste, but this corrects itself with time. Cattlemen feeding the DPW report no health problems with cattle. Some even claim that cows seem to have less problems cleaning after calving. (Bates-East Central)

4258-A11, B3, D2, D3, E3

RECYCLING SOLVES WASTE MANAGEMENT PROBLEMS

Anonymous
Progressive Farmer, V. 92, No. 7, p. 50, July, 1977. 1 fig.

Keywords: Refeeding, Ensiling, Cattle wastes, Poultry wastes, Cattle, Performance.

Dr. Brady Anthony, Auburn University researcher, began developing a process of feed reclamation through ensiling animal wastes in 1959. An example of how the process has been effectively put into use may be seen at Fred Dobbins' farm in Townville, South Carolina. The low end of this concrete feedlot is built up to truck-bed height. The hopper of a chain-flight elevator is placed so that waste drops directly into it as the feedlot floor is cleaned. The elevator drops waste into a mixer truck that has previously been loaded with corn silage and ground shelled corn. The final mixture is 15 percent corn silage, 45 percent ground shelled corn, and 40 percent manure. This is blown into a second bottom-unloading concrete silo where it normally stays for 3-4 weeks before being fed. Animals consuming this silage have made good, economical gains. An improvement of 10-15 percent in feed efficiency can be expected. Two keys to producing good quality manure are: (1) Manure should come from animals fed a high-grain ration -- a high-energy diet. (2) Manure should be harvested before it putrifies -- 2-3 times a week. (Bates-East Central)

4259-B2, B4, E2

FAMILY FORMS PARTNERSHIP TO FINISH HOGS

H. Ernst
Missouri Ruralist, V. 118, No. 7, p. 62-63, April 9, 1977. 2 fig.

Keywords: Management, Swine, Confinement pens, Slatted floors, Manure pits, Liquid wastes, Land spreading, Iowa.

Mr. and Mrs. Dillard Carmack and sons of Forest Green, Iowa combined their grain operation with a hog finishing enterprise. By marketing their corn through hogs, they believe they can earn extra income in most years. The Carmacks switched from dirt lots to environmentally controlled confinement with good results. The panelized building, designed and built by Winnebago of Eldora, Iowa, is very durable. The 640-head building is 34 feet wide by 100 feet long. Pen dividers of the 31-pen unit are made of concrete blocks and slats are also concrete. The slats are above 8-foot-wide, six-foot-deep manure pits on both sides of the building. Manure and liquid are pumped from the pits together for maximum removal for land spreading. About 6 inches of manure is left on the flat surfaced floors of the pits. The Carmacks have found that the hogs reach market weight at least a week sooner than they did under the previous system. (Albertson-East Central)

4260-C2, D3, E3

BIOLOGICAL POTENTIAL OF THERMOPHILIC METHANOGENESIS FROM CATTLE WASTES

Department of Dairy Science, University of Illinois, Urbana, Illinois
M. P. Bryant, B. H. Varel, R. A. Frobish, H. R. Isaacson
Seminar on Microbial Energy Conversion. E. Goltz KG, Gottingen, Germany, 1976. p. 347-359. 3 fig., 5 tab., 12 ref.

Keywords: Recycling, Cattle wastes, Methane, Anaerobic reactors, Temperature, Loading rates.

Methane production from waste of beef cattle fed a high-grain finishing diet was investigated using continuously stirred 3-liter-working-volume anaerobic reactors at 60°C. At 55°C an effective culture readily adapted to 60° C where methane production was greatest. When feed concentrations of volatile solids (VS, organic matter) were increased in steps of 2 percent after equilibration at a given percent VS, the maximum concentrations for efficient fermentation were 8.2, 10.0, 11.6, and 11.6 percent VS for the retention times (RT) of 3, 6, 9, and 12 days, respectively. The VS destructions for these and lower VS concentrations were 31-37, 36-40, 47-49, and 51-53 percent for the 3, 6, 9, and 12-day RT, respectively; and the corresponding methane production rates were about 0.16, 0.18, 0.20 and 0.22 liter/day/g VS in the feed (volume corrected to 0°C, 760 mm Hg). At these RT and feed concentrations, pH rose to 7.5-7.8, NH_3 to 64-90 mM and volatile acids to 850-2050 mg/liter. The 3-day-reactor fed 8.2 percent VS produced methane at the very high rate of 4.5 liters/ day liter of reactor. Similar results were obtained with a second lot of waste. They indicate that loading rates can be much higher than those generally thought possible for maximizing methanogenesis from cattle waste. When wastes of dairy cattle fed diets containing corn silage and haylage as 72 percent of the dry matter were studied, methane production and VS destruction averaged only 62 and 63 percent of comparable values for the feedlot waste. The solid waste annually produced by farm animals in the United States is estimated at two billion tons; and roughly half of this is produced by intensive animal production systems (Bhattacharya and Taylor, 1975; Humphrey, 1975). Anaerobic bacterial conversion of this waste with methane production may offer a partial solution to the resultant problems of pollution (Miner and Smith, 1975) and also serve to supplement the supply of natural gas. Research of Pfeffer (1974 and this seminar) and Pfeffer and Liebman (1976) indicate that methanogenesis from municipal organic refuse may become economical and especially if carried out at thermophilic temperature. Higher rates of digestion, greater conversion of waste to gas, faster solid-liquid separation, less capital costs, and less threat of microbial pathogens are some benefits obtained with the higher temperature. While some work has been done on methanogenesis from cattle wastes (Miner and Smith, 1975), little has been done at the optimum thermophilic temperature or at high loading rates (Turk and Coe, 1972). Our studies were initiated to investigate the biological efficiency of thermophilic methanogenesis at long to short retention times (RT) and from low to high influent feed concentrations. (Bryant-University of Illinois)

4261-A4, B2, C1, C2, C3, D3

OVERLAND FLOW TREATMENT OF SWINE LAGOON EFFLUENT

Agricultural Engineering Department, Oregon State University, Corvallis, Oregon
T. L. Willrich and J. O. Boda
Paper No. 76-4515, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 17 p. 9 fig., 4 tab., 7 ref.

Keywords: Overland flow treatment, Swine waste, Lagoons, Effluents, Water pollution, Sampling, Chemical properties, Physical properties, Biological properties, Waste water treatment.

The study objectives were to measure concentration attenuation and mass reduction of potential water pollutants in swine manure lagoon effluent as the result of overland flow treatment and to examine the influences of experimental variables on the effectiveness of the overland flow treatment process. Effluent from an anaerobic swine manure lagoon was applied at the upper end of 6 plots (3 planted in redtop and 3 planted in fescue) which were located on a sloping terrain of about three percent. Runoff from each plot was collected in a holding tank. Wastewater grab samples were collected from the holding tank at 0 and 100 feet throughout the study period and at distances at 12.5, 25, 50, and 75 feet from the distribution troughs by using a roast baster for suction. Averaging the data obtained from the 6 plots on all sampling dates during the 13-month study regardless of seasonal differences and variations in application rates and cover conditions yielded significant concentration reduction percents as follows: COD, 16, BOD_5, 32, PO_4, 16; NH_3-N, 25; salinity, 16; turbidity, 33; and fecal coliform 24. Removal of BOD and turbidity became more effective with time; whereas, treatment effectiveness in attenuating COD, PO_4, NH_3-N and salinity concentrations decreased with time. Mass reduction of measures properties was less with higher application rates when an average of 60 percent of the influent volume was collected as one-half of the applied volume. Significantly greater concentration attenuations were measured for turbidity and fecal coliform during wet, cool months and for PO_4 and salinity during dry, warm months. Nitrification was also significantly greater during dry, warm months. A linear relationship between concentration and flow distance existed for most measured properties. No significant differences were measured as the result of different grass cover conditions. (Albertson-East Central)

4262-A5, A11, A12, B1, B5, C2, C3, E3, F1

CAN CITY SEWAGE BE RECYCLED SAFELY ON FARM LAND?

Anonymous
Sunshine State Agricultural Research Report, V. 22, No. 1 & 2, p. 3, 6-7, Spring, 1977. 2 fig.

Keywords: Recycling, Sewage, Municipal wastes, Land application, Refeeding, Environmental effects, Groundwater pollution, Animal health, Public health, Economics, Heavy metals, Pesticides, Viruses, Pathogenic bacteria.

The U. S. Environmental Protection Agency has awarded the Institute of Food and Agricultural Sciences a $786,350 grant to study the safety of using municipal sewage wastes to irrigate and fertilize pastures. The research will involve 20 scientists in agriculture, environmental engineering, and veterinary and human medicine. Land spreading is being studied as a disposal alternative because it is less expensive than most other options and because it permits the recovery of valuable nutrients from treated sewage. But there is concern about the risks of heavy metals, pesticides, viruses, and other pathogens that remain in the sewage after it leaves the treatment plant. Research will be aimed at finding out how to keep these substances from being accumulated in dangerous quantities, particularly from the standpoint of animal and human health. Sewage effluent and sludge from treatment plants in Gainsville and Pensacola, Florida will be spread on experimental pasture plots near these cities and near Live Oak and Ona, Florida. Sludge will be imported from Chicago and similar urban areas so the scientists can measure the effects of applying wastes with large concentrations of heavy metals and other harmful substances commonly found in industrial wastes. Different concentrations of effluent and sludge will be applied to pastures, measuring the extent to which heavy metals, viruses, and other materials may contaminate groundwater or be absorbed by plants. Loading studies will be performed to identify the concentrations of effluent and sludge that will be acceptable from an environmental and health standpoint. A variety of cattle feeding trials will also be conducted, measuring the extent to which heavy metals, viruses, and other substances affect the health of grazing animals. Varying amounts of sludge will also be incorporated directly into the diet of cattle, swine, and poultry to establish safe and toxic exposure levels. (Rowe-East Central)

4263-B1, F1

HANDLE WASTE CHEAPLY WITH PARTIAL SLATS

Anonymous
Wallaces Farmer, V. 102, No. 4, p. 87, Feb. 26, 1977.

Keywords: Waste management, Totally slatted floors, Partially slatted floors, Solid concrete feeding floors, Open gutter flushing systems, Economics, Swine, Costs, Fertilizer value.

A Purdue University study of 4 swine waste handling systems made a comparison of total slat, partial slat, solid feed floor, and open gutter flushing systems. Net costs, system costs minus the fertilizer value, were computed. Total system costs, the total of operational costs and ownership costs, were also computed. For net cost per pig, the cheapest waste handling system was partially slatted at a cost of $1.04/pig. The concrete feeding floor system was second at $1.25. The open gutter flushing system was third at $1.45. The totally slatted system had a net cost of $1.72. For total system cost, the open gutter flushing system was cheapest at $1.97. The partially slatted system was second at $2.69. Concrete feeding floor ranked third at $3.05, with the totally slatted floor ranking last at $4.27/pig produced annually. Ownership and operating costs for each system are broken down. When fertilizer returns were computed, the totally slatted floor had the highest fertilizer return at $2.55/pig. The concrete feeding floor stood second at $1.80. The partially slatted floor return was $1.65. Open gutter flushing had a return of 52¢/pig. System specifications for each system are outlined as follows: (a) totally slatted system -- 6-ft.-deep holding pit, 1500-gal. vacuum manure tanker, space allowance of 7 sq. ft./hog, and pit allowance of 42 cu. ft./hog, (b) partially slatted system -- 1/3 of barn was slatted over a 3-ft.-deep pit, lagoon for pit overflows with capacity of 150 cu. ft./hog, 800-gal. tanker unit to pump the pit, 150 gal./minute irrigation system to empty the lagoon, (c) concrete feeding floor -- 5 sq. ft./head under roof and 15 sq. ft. of open concrete lot, scraping monthly, 100-bu. manure spreader, 20,000 cu. ft. pond to hold floor runoff, 50 gal./manure irrigation system to pump the runoff from the lagoon, lagoon capacity of 40 cu. ft./hog, front-end loader. (Albertson-East Central)

4264-A11, B1, C3, D1, D3

SURVIVAL OF *SALMONELLA TYPHIMURIUM* IN DAIRY COW WASTE

Auburn University, Auburn, Alabama
T. A. McCaskey and M. A. Jaleel
Journal of Dairy Science, V. 58, No. 5, p. 766-767, 1975.

Keywords: Dairy wastes, *Salmonella typhimurium*, Time, Temperature, Aeration, Incubation.

Studies were to determine effects of time, temperature, and aeration on survival and growth of *S. typhimurium* ATCC 14028 inoculated at 1100 organisms per 100 ml of dairy waste. *S. typhimurium* survived 44.4 days in dairy waste held at 10 C and 3.4 days in waste held at 35 C. Effect of aeration on the longevity of *S. typhimurium* in waste held at 10 C was not significant. However, a 99 percent reduction of the initial number of *Salmonella* in the aerated sample at 10 C was much faster (18 to 21 days) as compared to the 99 percent reduction time (28 to 35 days) in the nonaerated sample at 10 C. The mean survival time of *S. typhimurium* in aerated dairy waste at 35 C was much longer (16 days) than the mean survival time in the comparable nonaerated sample (3.4 days). A 99 percent reduction in the number of *S. typhimurium* in the aerated waste occurred during 12 to 18 days of incubation whereas in the nonaerated waste 99 percent reduction occurred between 3 and 6 days of incubation. (Copyright 1975 - Journal of Dairy Science) (Abstract only)

4265-B1, B4, E1, E2, F2
DESIGN OF ANIMAL WASTE DISPOSAL SYSTEMS

Tennessee Department of Public Health, Division of Water Quality Control and U. S. Department of Agriculture, Soil Conservation Service, University of Tennessee Extension Service
Engineering Standard, Animal Waste Disposal System, Chapter 7, Tennessee Department of Public Health, 1973, 10 p.

Keywords: Engineering standards, Legal aspects, Design, Waste disposal, Anaerobic lagoons, Holding tanks, Holding ponds, Detention basins.

An animal waste disposal system may be described as a system of structural works designed to retain both liquid and solid waste and polluted runoff from animal feeding areas, milking areas and other confinement areas and to provide for their subsequent disposal without pollution of surface or subsurface water. This standard provides the minimum acceptable quality for the design and construction of disposal systems located to serve rural areas. Systems will include such practices as detention basins, holding tanks, holding ponds, anaerobic lagoons, and liquid disposal systems. Where site conditions will not permit systems that meet the following criteria, other criteria and waste disposal techniques may be used that are approved by the Division of Water Quality Control. Design criteria are given for: (1) structural works to divert runoff, (2) structural works to convey waste, (3) anaerobic lagoons, (4) holding tanks, and (5) holding ponds. (Albertson-East Central)

4266-A8, B5, C2, E2
RECYCLE SOLID ANIMAL WASTES

T. C. Tucker and J. L. Abbott
Progressive Agriculture in Arizona, V. 26, No. 1, p. 6-7, Jan.-Feb., 1974. 1 fig., 1 tab., 6 ref.

Keywords: Land application, Crop response, Cotton, Barley, Alfalfa, Nitrogen, Phosphorus, Loading rates.

Experiments were conducted at the University of Arizona's Cotton Research Farm from 1960 through 1970. Study emphasis was on the contributions to the available nitrogen and phosphorus for crop plants. In the initial experiment, cotton yields were higher from 1960 through 1964 when manure was applied at the rate of 10 tons/acre/year when compared with the application of adequate amount of fertilizer nitrogen. The phosphorus content of the cotton leaves was much higher with manure application than with the application of commercial fertilizer nitrogen and phosphorus. Cotton yields were higher with manure than with only nitrogen application. After cotton harvest in the fall of 1968, soil samples were taken from each treatment and analyzed for phosphorus. Results showed increasing amounts of extractable phosphorus corresponding to increasing rates of manure application during the preceding 4-year period. Barley followed cotton in 1968. Alfalfa was planted in 1969. It was found that manure was an effective source of phosphorus as was shown by increased phosphorus content of cotton, barley, and alfalfa as well as soil analysis. These effects were shown to last for several years after the last manure application. Beneficial effects of manure on soil physical condition -- tilth, aeration, and water relationships -- probably contribute appreciably to increased productivity and are associated with microbial activity. Rates of manure application of the order of 5-10 tons/acre annually will provide adequate nitrogen and phosphorus for most crop without excessive land loading to the point of creating a pollution hazard. (Bates-East Central)

4267-A3, A4, B5, C2, E2
POLLUTION POTENTIAL OF MANURE SPREAD ON FROZEN GROUND

Agricultural Engineer, U. S. Department of Agriculture, Morris, Minnesota
R. A. Young and C. K. Mutchler
Journal of Environmental Quality, V. 5, No. 2, p. 174-179, 1976. 2 fig., 7 tab., 7 ref.

Keywords: Water pollution, Manure, Land application, Agricultural runoff, Erosion, Nutrients, Frozen ground, Snowmelt runoff.

Studies were begun at Morris, Minnesota in 1971 to determine the contribution of manure application on frozen ground to the nutrient content of snowmelt runoff. Eight experimental plots, 4.06 m wide by 23.35 m long, with a 9 percent average slope, were set up on land furnished by the University of Minnesota's West Central Experiment Station. Two plots were planted in newly seeded alfalfa with an oat cover crop. Two plots were left in 6-year-old alfalfa. Manure treatments on the 4 corn plots consisted of 44.8 metric tons/ha solid dairy manure, wet basis, (a) applied in fall and plowed under, (b) applied in fall on frozen ground, (c) applied in spring on top of snow and (d) check plot, no manure applied. Treatments on the 4 alfalfa plots (both the newly seeded and the 6-year-old) consisted of 44.8 metric tons/ha solid dairy manure, wet basis, (a) applied in fall on frozen ground, and (b) applied in spring on top of snow. During the second year of the experiment, the spring manure treatment on the established alfalfa plot was eliminated and the plot was used as a check with no manure applied. Third year treatments on the 4 alfalfa plots were changed to: (a) check, (b) 1.27 cm liquid dairy manure applied in fall on frozen ground, (c) 1.27 cm liquid dairy manure applied in spring on top of snow, and (d) 0.64 cm liquid dairy manure applied in fall followed by another 0.64 applied in spring. Study results indicated that concentrations of nutrients in runoff water were much higher from the manured plots than from the check plots, but the total nutrient losses in surface runoff from the manured plots were not much greater due to the efficiency of the manure in retarding runoff and soil loss. Manure spread on top of snow rather than before snowfall was generally better for reducing soil, water, and nutrient losses. Applying manure to frozen plowed land reduced soil losses 100 percent and runoff up to 80 percent. (Albertson-East Central)

4268-A8, B1, B5, C2, E2
CATTLE MANURE: I. EFFECT ON CROPS AND SOILS. II. RETENTION PROPERTIES FOR CU, MN, AND ZN

R. F. Hensler
Ph. D. Dissertation, University of Wisconsin, 1970, 101 p. 1 fig., 16 tab., 52 ref.

Keywords: Dairy manure, Cattle manure, Land application, Crop response, Nutrients, Soil analysis, Agricultural runoff, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulfur, Iron, Molybdenum, Zinc, Acid soil conditions, Neutral soil conditions.

Part I of this dissertation concerns the effect of handling dairy cattle and steer manures in fresh, fermented, aerobic liquid, and anaerobic liquid forms on crop yields, nutrient recovery, soil fertility levels and runoff losses. Results showed that the application of manure to Miami silt loam in the greenhouse gave increased corn dry matter yield in all cases. Fresh, fermented and anaerobic liquid dairy cow manures gave similar increases in yield but were superior to those for aerobic liquid manure. Similar trends were noted for steer manure. The crop recovery of N and P usually followed a pattern similar to yield. The recovery values for N, P, and K usually were lower when manure dried for one week before incorporation. Total dry matter yields of corn were reduced by increasing amounts of bedding up to 16 percent. On the Rozetta soil, there were no real differences due to type of manure or time of application. There was a higher loss of N, P, and K when applied in winter than in spring. On the Withee soil, for fresh manure, the corn dry matter yields were lower than for comparable treatments with fermented or anaerobic liquid manures. The increase in grass or weeds over legumes for the summer-applied manure was the most pronounced effect of top dressing liquid manure on alfalfa-grass meadow, especially at the 40 to 60 ton rates. Part II concerns the effects of liming and rates of application of manure on corn yields and concentration and recovery of 12 plant nutrients. It was found that dry matter yields of corn were indirectly related to rate of manure application and were significantly higher for medium rates of application (68 and 204 mt/ha) on the unlimed soil (pH 4.5) than on the limed (pH 7.3) soil. Ca, Mg, P, S, Fe, and Mo plant tissue concentrations were usually higher for limed soil than for unlimed soil, but the reverse was true for Zn and Mn. In most cases recovery of plant nutrients from the manure was indirectly related to application rate and was much higher on unlimed soil than on limed soil for all nutrients except K and S. Part III deals with the capacity of dairy cattle feces to complex Cu, Mn, and Zn from solutions of their salts. Plant response to application of feces plus urine enriched with these elements was also studied. Dairy cattle feces retained between 70 and 90 percent of added Cu, Mn, and Zn and similar amounts were retained by freeze-dried and fresh feces. Retention of Cu, Mn, and Zn was independent of time between 0.5 and 72 hours. Although the feces retained these elements in the order $Cu > Zn > Mn$, desorption in a 0.1 $\underline{M}$ NaCl system was in the order $Mn > Cu > Zn$. 0.1 $\underline{M}$ $CaC1_2$ replaced more Mn and Zn than did 0.1 $\underline{M}$ NaC1 or water. Cu was not replaced by 0.1 $\underline{M}$ $CaC1_2$. There were no appreciable differences between feces from dairy cattle fed corn silage or haylage with regard to Cu, Mn, and Zn retention. Feces from the Guernsey breed retained slightly higher amounts of these elements than those from the Holstein breed. There was no response in yield to feces and urine enriched with Cu, Mn, or Zn added to a soil in a greenhouse experiment but there was a significant increase in Cu and Zn concentration of the tissue. (Rowe-East Central)

4269-B1, C2, D3

DYNAMIC RESPONSE OF AN ANAEROBIC DIGESTER WITH DAIRY COW SUBSTRATE

J. L. Halderson
Ph. D. Dissertation, Purdue University, Jan., 1972, 129 p. 17 fig., 29 tab., 46 ref.

Keywords: Dairy wastes, Anaerobic digestion, Loading rates, Detention time, Chemical properties, Gas production.

An investigation was made of the dynamic response of anaerobic digestion when subjected to several levels of step rate changes in loading. Laboratory sized, continuously mixed four-liter digesters, constructed of acrylic and maintained at 35°C were batch fed with dairy manure once a day. A 15-day detention time was maintained throughout the study. Dependent parameters measured were total and volatile solids, total alkalinity, pH, COD, gas production and composition, and total volatile acid concentration and composition. The average system pH was approximately 6.85 (±0.10 with a range of roughly 6.7 to 7.0). Higher loading rates slightly increased pH. Alkalinity averaged approximately 2850 mg/L (±150) as CaCo$_3$ and varied little throughout the range of loading. Alkalinity always appeared to be sufficient to neutralize volatile acids without greatly affecting pH. At the maximum loading rate tested (approximately 0.5 lb VS/ft^3 -day), gas production was 6.1 ft /lb VS added, volatile solids reduction was 55 percent, COD reduction was 35.6 percent, pH approximated 6.85, and system alkalinity was approximately 2850 mgm/L. Higher loading rates could not successfully be achieved with a digester of this design due to problems of feeding a higher solids content substrate and to foaming of the digester contents. A 15-day detention time seemed to be sufficient for allowing the microbial population time to stabilize after a step change in loading rate. However, there were indications that a 15-day detention time did not permit stabilization to be completed for the magnitude of step changes in loading rate used in this experiment. (Albertson - East Central)

4270-A9, A10, B1, D2

COMBAT CATTLE FLIES WITH THESE WEAPONS

Anonymous
Wallaces Farmer, V. 102, No. 9, p. 27, May 14, 1977.

Keywords: Fly control, Face flies, Horn flies, Pastures, Feedlots, Backrubbers, Dust bags, Feed additives, Insecticides, Sanitation.

Horn flies and face flies can be a real nuisance to cow-calf herds out in the pasture, often causing grazing and weight gain problems. Four general methods for controlling flies on pasture cattle are: (1) Place backrubbers in the entry ways to waterers or mineral feeders so that the animals are forced to use them regularly. Because the backrubber may not effectively control face flies if the animals don't rub their faces on the machine, insecticides may be used in them. Among the insecticides recommended are: Ciovap, Co-Ral, Delnav, Korlan, malathion, Ravap and Toxaphene. (2) Spraying of such insecticides as Ciovap, Co-Ral, Delnav, Korlan, malathion, Rabon, Ravap, and Toxaphene may also be used to help eliminate flies. Horn fly control should be adequate for 25 to 30 days. But face flies will return to pretreatment levels in 5 days or less because their life cycle is only 2 weeks long. (3) Dust bags filled with Ciodrin, Co-Ral, malathion, methoxchlor or Rabon may also be used for fly control. Because effectiveness of dust bags depends on frequency of use, they should be hung in the entryway to waterers or mineral feeders to insure usage. (4) Feed additives consumed by all animals in recommended dosages may also be used. These should be fed from May to September. Additives mentioned are fly control mineral blocks containing Ronnel or Phenothiazine and Rabon Oral Larvicide. Feedlot fly control may be handled differently than pasture fly control. Sanitation is the main key to fly control in feedlots. Fly breeding havens should be removed by periodic cleaning. Vapona and Dibram can be effectively sprayed in tractor-mounted mist blower at regular intervals to control flies. Regularly repeated applications are necessary because the materials are short lived and only kill flies on contact. Spraying such residual sprays as Baytex, Cygon, diazinon, Korlan, Rabon, and Ravap inside and outside surfaces of shelters, fences, shrubbery and weeds can also produce good results. The first application should be made the first week in June. These sprays must not be allowed to contaminate feed or containers of feed and water. (Hudson-East Central)

4271-B2, C2, D3

SHORT TERM MINIMUM AERATION OF SWINE MANURE

P. A. Phillips
M.S. Thesis, Department of Agricultural Engineering, McGill University, 1973, 117 p. 18 fig., 29 tab., 48 ref.

Keywords: Swine wastes, Waste treatment, Aeration, Dilution rate, Flow rate, Waste water quality, Chemical oxygen demand.

A short-term, minimum aeration, continuous culture treatment for swine manure was designed on a laboratory scale to test several hypotheses, chiefly the hypothesis that dilution rate and/or flow rate have no effect on effluent quality. Three levels of dilution rate and three levels of flow rate were tested. No significant difference was observed in reduction in soluble chemical oxygen demand (COD) within the inference space tested. No significant difference in soluble COD of the effluent was observed. The effect of the soluble COD in the in-feed manure on the soluble COD of the effluent was studied. Analysis of covariance indicated that effluent quality was independent of influent quality. (Phillips-McGill University)

4272-A1, B1, F2

DESIGN CONFERENCE ON LIVESTOCK WASTE MANAGEMENT SYSTEMS IN ILLINOIS

University of Illinois
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 118 p.

Keywords: Waste management, Illinois, Regulation, Waste storage, Waste treatment, Waste disposal, Design, Illinois.

The Design Conference on Livestock Waste Management Systems in Illinois was jointly sponsored by the University of Illinois, Agricultural Engineering Department and Cooperative Extension Service; USDA, Soil Conservation Service; Illinois Society of Professional Engineers; Consulting Engineers Council of Illinois; Illinois Institute for Environmental Quality; and Illinois Environmental Protection Agency. Topics considered include: the evolution of regulation of livestock waste management, and overview of Illinois agriculture, services provided by the Soil Conservation Service, services provided by the University of Illinois for the design of livestock waste management systems, properties and characteristics of livestock wastes, and types of waste management systems on Illinois farms. (Merryman-East Central)

4273-A1, B1, F4

AN INTRODUCTION TO ILLINOIS AGRICULTURE

Specialist in Natural Resources, Cooperative Extension Service, College of Agriculture, University of Illinois, Urbana-Champaign, Illinois
R. D. Walker
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 16 p. 5 fig., 9 ref.

Keywords: Illinois, Soils, Vegetation, Weathering, Climate, Transportation, Crop production, Beef cattle, Dairy industry, Poultry.

The contribution of Illinois' agriculture to the nation and to the world are easily visible. However, in order to continue at our present rate of production and to increase efficiently, we must take serious precautions. We must look at the total impact of modern agricultural technology and seek solutions to the inherent degradation of land, and water and environment which creeps slowly from behind as farmers continue to increase the intensity of their farming operations. We must monitor our soil, water and air for possible environmental damage and adjust our system to correct problems created. Your contribution to the proper handling of livestock and their waste can greatly benefit agriculture and society. (Walker-University of Illinois)

4274-A8, B1, B5, C2, E2

CROPPING PRACTICES ON ILLINOIS LIVESTOCK FARMS

M. D. Thorne
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 16 p.

Keywords: Crop production, Forages, Land application, Livestock wastes, Nitrogen, Phosphorus, Potassium, Application rates.

Most Illinois farmers who produce livestock of any kind also produce most of the grain and forage eaten by their livestock. The most common crop rotations on Illinois farms consist of various sequences of corn and soybeans. Pasture and hay crops may rotate with corn and/or soybeans on livestock or mixed farms, but more often they are grown more or less continuously on separate land. Sudangrass, sudangrass hybrids and sorghum-sudangrass hybrids ate annual grasses which are quick growing and quite palatable. They are usually grazed or made into silage. Corn is grown for silage on many livestock farms. Maintenance of proper pH through liming is very important for forage production. Maintenance of soil pH above 6.0 is usually adviseble for grain crops and above 6.5 for legume crops. Pasture and hay crops offer certain advantages over grain crops in utilization of livestock wastes. Forage crops will remove more N, P and K than are removed in grain crops. Consequently, higher application rates can be made. If application is by irrigation, the soil is better protected and less runoff and erosion results. The long growing season of perennial forages reduces the probability of nitrate accumulation in the soil and its movement through the profile where it may contaminate ground water. Legumes, such as alfalfa, clover, and soybeans, do not require nitrogen additions in fertile soils, so little or no response to the nitrogen in animal wastes can be expected. (Merryman-East Central)

4275-B1
FARMERS AS CLIENTS

S. Barclay
Design Conference of Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 7 p.

Keywords: Design, Waste management, Consulting engineers, Equipment, Settling basins, Lagoons.

As the business of farming has become more sophisticated and harder to manage, farmers have turned to professionals (lawyers, accountants, veterinarians) for assistance. However, as of yet, they have not used the services of consulting engineers to any great extent. One area where consulting engineers could be of great service to farmers is in the design of livestock waste handling systems. Consultants should, however, be very flexible in the types of services that they provide so that they can match the needs of their clients. (Barclay)

4276-A4, B1, F2
FEDERAL LIVESTOCK WASTE REGULATIONS

Professor and Extension Agricultural Engineer, University of Illinois, Urbana-Champaign, Illinois
A. J. Muehling
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977. 7 p.

Keywords: Legal aspects, Regulation, Feedlots, Permits, Water pollution, Illinois.

The evolution of the Federal Water Pollution Control Act Amendments of 1972 is outlined. Feedback from the livestock industry caused Short Form B for application for permits to be simplified. The Natural Resources Defense Council (NRDC), an environmental group which has taken it upon itself to police environmental legislation to make certain that all classes of activity causing pollution are included, accused the EPA of omitting the smaller feedlots and filed suit against the Administration. NRDC won its case and EPA was ordered to propose regulations which include all point sources. Although EPA has appealed the case, it subsequently made these changes: the 2500-hog number was changed to 4500 head, all the poultry numbers were made larger, and applications for a permit were required for all feedlots discharging wastes directly into a stream. A proposed regulation was published November 5, 1975. The final regulations were published in the March 18, 1976 Federal Register. The regulations require that application for a permit be made for all feedlots over 1000 animal units if there is a discharge of pollutants. If the discharge occurs only following a 25 year, 24-hour storm event, a permit is not required. For feedlots between 300 and 1000 animal units, a permit is required if pollutants are discharged through a man-made conveyance or if pollutants are discharged into waters passing through or coming into direct contact with animals in the feedlot. Also, these feedlots can be inspected and compelled to apply for a permit if they are deemed to be pollution problems. Feedlots with less than 300 livestock units are not subject to the permit requirement unless designated as a polluter on a case-by-case basis. When the NPDES Feedlot program went into effect in 1974, Illinois livestock producers were in a quandary. Many were not sure if they were required to obtain a permit and others were afraid to ask, for fear they would then be identified to the EPA and receive regular monitoring. For these and other reasons, only 30 of the estimated 125 feedlots affected, made application for NPDES permits. An educational program needs to be set up to present these new regulations to the producers. (Merryman-East Central)

4277-B1, F2
STATUS OF ILLINOIS LIVESTOCK WASTE REGULATIONS

Illinois Environmental Protection Agency
R. L. Elliott
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977. 5 p.

Keywords: Regulation, Illinois, Legal aspects, Permits, Livestock wastes.

The history and current status of the Illinois Livestock Waste Regulations are reviewed. After several years of proposals and public hearings, Illinois Livestock Waste Regulations finally went into effect. On July 8, 1976, the Environmental Protection Agency transmitted to the Pollution Control Board proposed amendments to the Livestock Waste Regulations for the purposes of: (1) making the Regulations consistent with the revised NPDES program on animal feeding operations as contained in the *Federal Register* of March 18, 1976; and (2) setting a fixed compliance date for all livestock facilities not subject to the NPDES program. A portion of the livestock waste regulations is outlined. (Merryman-East Central)

4278-A4, B2, F2
CASE STUDIES OF WATER POLLUTION CAUSED BY FEEDLOT OPERATIONS AND FUTURE DEMAND FOR PRIVATE ENGINEERING SERVICES

Agriculture Advisor, Illinois Environmental Protection Agency, Springfield, Illinois
J. F. Frank
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 13 p. 4 fig., 4 tab.

Keywords: Feedlots, Swine, Cattle, Regulation, Permits, Illinois, Water pollution, Environmental Protection Agency.

Case studies are presented of 2 beef and 2 swine feedlot operations that have caused water pollution in Illinois. In case study 1, swine wastes from inadequate storage facilities were entering a stream below the feedlot which discharged directly to the head waters of Rend Lake, a municipal water supply reservoir serving 40,000 people in Southern Illinois. The facility was informed of its need to apply for an NPDES permit. A permit was issued in August of 1974 with a compliance date of October, 1974. The facility operator subsequently ceased operation at the facility and the NPDES permit was terminated. In case study 2, swine wastes from an inadequate storage pit were allowed to discharge over land to a small dry run stream, a tributary to the Mississippi. The operator indicated that he planned to build a lagoon to accept the overflow from the concrete pit. Since 1973, the facility has operated only on a sporadic basis and a lagoon has not been constructed to date. In case study 3, the lot owner had designed and constructed a non-discharging retention pond to catch the majority of runoff from his cattle lot. However the lagoon soon filled up and due to inadequate operational procedures, a diversion which directed feedlot runoff to the lagoon and the lagoon berm were both breached and the waste water entered a creek. After much prompting, the facility applied for an NPDES permit. The permit, issued in May, 1974, required controls to be installed by November, 1974. The facility missed all of the interim compliance dates in the permit. When the final date had elapsed and controls were still not in effect, the Illinois EPA filed an enforcement action for violations of water quality standards. The facility came into compliance during the course of the litigation. In case 4, a cattle feedlot operation was polluting a stream and the EPA suggested the construction of a retention pond. Subsequent delays and requests for extension of NPDES compliance dates occurred. The present status involves watching the interim compliance dates of a 309 Order from the U.S. EPA to insure compliance by June 31, 1977. (Merryman-East Central)

4279-B1, F1
SERVICES PROVIDED BY THE SOIL CONSERVATION SERVICE

State Conservation Engineer, U.S. Department of Agriculture, Soil Conservation Service, Champaign, Illinois
W. B. Moody
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 6 p. 1 fig.

Keywords: Soil Conservation Service, Financial assistance, Cost-sharing, Animal waste management systems, Engineering services, Illinois.

The Soil Conservation Service (SCS), an agency of the United States Department of Agriculture, was established in 1935 for the purpose of conserving soil and water resources, improving agriculture, and reducing damages caused by floods and sedimentation through assistance to local soil and water conservation districts, watershed groups, and state and other federal agencies. In Illinois, programs administered by the Soil Conservation Service are: (1) Conservation Operation Program, (2) Watershed Protection and Flood

Prevention Program, (3) Resource Conservation and Development Program, and (4) River Basin Surveys and Investigation Program. In addition to SCS programs, USDA, Agricultural Stabilization and Conservation Services (ASCS) provides financial assistance to landowners through the Agricultural Conservation Program. The purpose of the program is to provide cost-sharing for the construction of conservation practices which reduce erosion and sedimentation and improve the environment. The SCS plans, designs and provides technical assistance during construction of animal waste management systems through the Conservation Operation Program and the Agricultural Conservation Program. The engineering services provided depend on the nature and extent of the services, availability of SCS personnel, and relationship of SCS to the various recipients of the services and to private engineers, sponsors, and others. The planning, design, and construction of livestock waste management systems are generally installed for individual landowners and operators or groups of landowners and operators. The Soil Conservation Service does not have the resources to design and assist in installation of all of the waste management systems needed. Also, it is not the intent of the SCS to compete with qualified private engineers in the installation of these facilities. SCS strongly encourages landowners and operators to engage qualified private engineers when such assistance is needed. (Merryman-East Central)

4280-B2, F4

SERVICES PROVIDED BY THE UNIVERSITY OF ILLINOIS FOR THE DESIGN OF LIVESTOCK WASTE MANAGEMENT SYSTEMS

Extension Agricultural Engineer, Department of Agricultural Engineering, University of Illinois, Urbana-Champaign, Illinois
D. G. Jedele
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 6 p. 1 fig.

Keywords: University of Illinois, Animal waste management, Research, Teaching.

The organization of the University of Illinois leadership in livestock waste management is outlined. The Agricultural Engineering Department, which is jointly administered by the College of Engineering and the College of Agriculture, offers 2 curricula. One leads to a degree in engineering, the other leads to a degree in agriculture. Of the 4 divisions in Agricultural Engineering, the Structures and Environment Divison and the Soil and Water Division are giving attention to various engineering aspects of livestock waste management. The subject is part of research, teaching, international and extension programs of the department. All of these programs benefit the people of Illinois, but the direct service to the people is usually through the Cooperative Extension Service and/ or through the Office of Continuing Education and Public Service. The Agricultural Engineering Department has several extension specialists that spend part time on livestock waste management, but the total time that these specialists can devote to that subject is only equivalent to about one full-time person. Also, several agricultural engineers are involved with research on livestock waste management, but the total commitment is not more than 1 1/2 full-time equivalent professional staff. Within the framework of the organization, the extension agricultural engineers are responsible for conducting educational programs on livestock waste management for the interested people of the state. This is accomplished through (1) response to inquiries, (2) publications and (3) meetings short courses, and conferences. (Merryman-East Central)

4281-A1, B1, B4, C1, C2, C3

PROPERTIES AND CHARACTERISTICS OF LIVESTOCK WASTES

Professor of Agricultural Engineering, University of Illinois, Urbana-Champaign, Illinois
D. L. Day
Design Conference of Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 16 p. 7 fig., 9 tab., 17 ref.

Keywords: Livestock wastes, physical properties, Chemical properties, Biological properties, Agricultural runoff, Waste storage, Waste management.

This paper presents properties and characteristics of livestock wastes that are most commonly used in planning, layout, and design of livestock waste management systems and utilizing the wastes as crop nutrients. Amounts and characteristics of fresh excreta are given with expected gains in volume and losses in plant nutrients due to various methods of storage and treatment. It does not dwell on properties and characteristics important to other methods of utilization such as converting wastes into fuels or processing wastes for refeeding. (Day-University of Illinois)

4282-A1, B1, D3, E1

TYPES OF WASTE MANAGEMENT SYSTEMS ON ILLINOIS FARMS

Agricultural Extension Service, University of Illinois, Urbana-Champaign, Illinois
A. J. Muehling and D. H. Vanderholm
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 16 p. 8 fig., 1 tab.

Keywords: Illinois, Waste storage, Waste treatment, Waste disposal, Lagoons, Critical area planting.

Seven common manure-handling systems that are used by Illinois livestock producers are described. They are: (1) wastes from livestock on pasture -- grass buffer strips to control runoff, (2) solid floors with bedding -- store and haul, (3) slotted floors -- store and haul, (4) lagoon disposal, (5) slotted floors - combination of hauling and lagoon, (6) slotted floors -- oxidation ditch with lagoon, and (7) flushing. An animal waste management systems data sheet, a critical area planting site plan -- grasses and legumes, standards and specifications for critical area planting, and standards for a lagoon animal waste system are appended. Livestock producers are advised to plan carefully before enlarging their present units or building new units. If the present location is not desirable, it may be better to move to a new location instead of enlarging the present location and increasing the problem. To meet new anti-pollution regulations, livestock producers will be required to control runoff and keep odors to a minimum. (Merryman-East Central)

4283-A1, A8, B2, B4, B5, E2

A FARMERS VIEWPOINT, PART I - BEEF WASTE MANAGEMENT

Thawville, Illinois
R. Veatch
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977. 1 fig.

Keywords: Waste management, Cattle, Grassed waterway, Settling pond, Holding pond, Irrigation, Land application, Crop response, Corn, Soil Conservation Service, Environmental Protection Agency, University of Illinois.

A farmer outlines the evolution of his waste management system. In the early years of the farm, of the various increased conservation efforts, the practice of minimum tillage was perhaps the most important. When livestock numbers increased, total confinement became necessary and as a consequence, livestock wastes were hauled to the fields. The confinement lots were built 1,650 feet from an open ditch. Runoff from the feedlots crossed grassed waterways to the ditch. This resulted in manure saturated waterways and dead grass. The Soil Conservation Service was contacted for assistance. In 1970, a settling basin was built. Liquids leaving the settling basin traveled through two 4-inch pipes passing through an earth wall into the holding pond. The holding pond only had a capacity to hold an average year's rainfall, for the size of the area that was to drain into the pond. Problems developed. Evaporation during summer months was insufficient to lower the pond level adequately. Consequently, a 4-inch irrigation system that included 1650 feet of pipe, a gun nozzle, and a 4-inch pump was purchased. The pond water was pumped to 20 acres of cornfield. Another lot, not connected to the holding pond system, drained in a different direction from the other units to its own small holding pond. Contents of this pond were periodically transferred to the settling basin by a sludge pump. When there was a buildup of solids, the liquids were pumped out and the solids were scraped out and spread on the fields. Assistance from the SCS, the University of Illinois Agricultural Engineering Department, and the EPA was invaluable in solving this farmer's problems. (Merryman-East Central)

4284-A6, B2, B5, E2

THE FARMER'S VIEWPOINT, PART II - SWINE WASTE MANAGEMENT

Tazwell County Pork Producer, Delavan, Illinois
R. Jeckel
Design Conference on Livestock Waste Management Systems in Illinois, Champaign, Illinois, March 8-10, 1977, 5 p. 3 fig.

Keywords: Waste management, Swine wastes, Confinement pens, Lagoons, Odor, Land spreading.

A swine farmer traces the evolution of his pork production facilities over a period of 27 years. Originally, the pasture system was used. This system required a minimum amount of capital but a high labor input. Gradually, capital was substituted for labor and land. Partially slatted finishing buildings were built. A waste-handling system was constructed which included a lagoon (now used as a retention pond for overflow liquids) and an injector-spreader wagon for putting waste into the soil. Many of these changes occurred because the encroachment of new homes near the farm necessitated that something be done about the problem of odor from the wastes. The farmer is presently adding facilities further from town. The new buildings have 8 feet deep pits so that the waste can be held for extended periods of time. These deeper pits will permit all waste to be stored under a roof without the possibility of any runoff or dilution by rainfall. (Merryman-East Central)

4285-A10
INSECTS ASSOCIATED WITH BOVINE DROPPINGS IN KERR AND BEXAR COUNTIES, TEXAS

Entomology Research Division, Agricultural Research Service, U.S. Department of Agriculture, Kerrville, Texas 78028
R. R. Blume
Journal of Economic Entomology, V. 63, No. 3, p. 1023-1024, June, 1970. 1 tab., 8 ref.

Keywords: Insects, Cattle manure, Texas.

Insects associated with bovine droppings were collected and identified during studies of the ecology of the horn fly in Kerr County, Texas and in Bexar County, Texas. Three collection methods were employed: (1) droppings were covered with emergence traps, (2) a sweep net was used to capture insects in the immediate vicinity of droppings, and (3) droppings collected in the field were placed in Berlese funnels in the laboratory. A total of 103 insect species representative of 45 families of 5 orders have been identified to date. Two insects, *Bibio holti* and *Sepsis brunnipes*, apparently are 1st records for Texas. The insects that were identified are listed. (Merryman-East Central)

4286-A9, A10, B1, C2
RESIDUE DETERMINATION OF THOMPSON-HAYWARD 6040 IN BOVINE MANURE BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Veterinary Toxicology and Entomology Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, College Station, Texas 77840
D. D. Oehler and G. M. Holman
Journal of Agricultural and Food Chemistry, V. 23, No. 3, p. 590-591, 1975. 1 fig., 4 ref.

Keywords: Insecticides, Fly control, Feedlots, Cattle manure, Thompson-Hayward 6040, Liquid chromatography.

Residues of TH 6040, 1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl) urea, were determined in bovine manure at levels between 2.0 and 0.5 ppm. Samples were cleaned up by liquid-liquid partition and elution through a Florisil column. Analysis was performed with reverse-phase high performance liquid chromatography. (Copyright 1975 - Journal of Agricultural and Food Chemistry)

4287-B2, C2, D2, D3, E3
SYNTHESIS GAS FROM BOVINE WASTES

Department of Chemical Engineering, Texas Tech University, Lubbock, Texas 79409
J. E. Halligan, K. L. Herzog, and H. W. Parker
Industrial and Engineering Chemistry, Process Design and Development, V. 14, No. 1, p. 64-69, 1975. 5 fig., 4 tab., 16 ref.

Keywords: Recycling, Cattle wastes, Gases, Fluidized-bed reactor, Ammonia.

The potential of a process to convert cattle feedlot manure to ammonia synthesis gas was investigated by designing, constructing, and operating a fluidized-bed reactor system. Significant yields of synthesis gas were obtained when this system was fed a mixture of manure, air, stream, and a very small stream of carbon dioxide. This synthesis gas was deemed to be suitable for subsequent conversion to anhydrous ammonia using existing technology. (Copyright 1975 - Industrial and Engineering Chemistry, Process Design and Development)

4288-A9, A10, A11, B1, C2
FEEDING TH 6040 TO CATTLE: RESIDUES IN TISSUES AND MILK AND BREAKDOWN IN MANURE

Chemical and Biophysical Control Laboratory, Agricultural Environmental Quality Institute, Agricultural Research Service, Beltsville, Maryland 20705
R. W. Miller, C. Corley, D. D. Oehler, and L. G. Pickens
Journal of Agricultural and Food Chemistry, V. 24, No. 3, p. 687-688, May-June, 1976. 1 fig., 1 tab., 5 ref.

Keywords: Insecticides, Feed additives, Fly control, Dairy cattle, Performance, Residues, Tissues, Milk, Cattle manure.

Three dairy cows were fed Thompson-Hayward TH 6040 (N-(4-chlorophenyl)-N'-(2,6-difluorobenzoyl) urea) at rates ranging between 0.25 and 16 mg/kg body wt per day for 4-5 months. No (0.02 ppm) TH 6040 was found in the milk of the cow fed as much as 8 mg/kg body wt, and even when 16 mg/kg body wt was fed, only 0.02 ppm was found in the milk. The maximum residue found in the body fat of this cow was 0.25 ppm. TH 6040 in the manure (exposed outdoors) of a cow fed 0.25 mg/kg body wt decreased over time at a rate described by a hyperbolic curve; the half-life was 4-5 days. (Copyright 1976 - Journal of Agricultural and Food Chemistry)

4289-A9, A11, B1, C2
ACCUMULATION AND EXCRETION OF CERTAIN ORGANOCHLORINE INSECTICIDES IN BROILER BREEDER HENS

Spelderholt Institute for Poultry Research, Beekbergen, Netherlands
C. A. Kan and L. G. M. Th. Tuinstra
Journal of Agricultural and Food Chemistry, V. 24, No. 4, p. 775-778, July-Aug., 1976. 5 tab., 15 ref.

Keywords: Insecticides, broilers, Feed additives, Residues, Eggs, Poultry Wastes, Abdominal fat.

The accumulation of hexachlorobenzene, α-, β- , and γ-hexachlorocyclohexane, heptachlor, p, p'-DDT, and dieldrin in abdominal fat and eggs was determined in an experiment with broiler breeder type laying hens. The accumulation ratios (level in fat or egg/level in the feed) in fat on a fat basis were 17, 1.8, 18, 1.8, 6, 14, respectively. Calculations were made on excretion of the total daily intake via eggs and feces. The values ranged from 25 to 35 percent for HCB, β-HCH, DDT, and dieldrin, to 10 percent for heptachlor, to 2-3 percent for α- and γ-HCH via the eggs. The excretion via feces was 5-10 percent for HCB, β-HCH, DDT, and dieldrin, 2 percent for heptachlor, and for α-and γ-HCH ≤0.5 percent of the daily intake. (Copyright 1976 - Journal of Agricultural and Food Chemistry)

4290-A11, B1, C2
LONG-TERM STUDIES OF RESIDUE RETENTION AND EXCRETION BY COWS FED A POLYCHLORINATED BIPHENYL (AROCLOR 1254)

Agricultural Environmental Quality Institute, Agricultural Research Center, Agricultural Research Service, Beltsville, Maryland 20705
G. G. Fries, G. S. Marrow, Jr., and C. H. Gordon
Journal of Agricultural and Food Chemistry, V. 20, No. 6, p. 117-121, Nov.-Dec., 1972. 3 fig., 4 tab., 17 ref.

Keywords: Feed additives, Polychlorinated biphenyls, Aroclor 1254, Dairy cattle, Performance, Residues, Milk, Cattle manure.

Nine cows were fed 200 mg per day of Aroclor 1254 (PCB) for 60 days. Milk and body fat samples were obtained during and for 60 days following feeding. Concentrations of PCB in milk fat approached equilibrium after 40 days. The average concentration in milk from 40 to 60 days was 60.9 ± 4.5 μg/g fat. Concentration in body fat was 41.7 ± 11.5 μg/g at 60 days. When feeding stopped, concentration in milk fat declined 50 percent within 15 days. After 15 days the rate of the first-order decline in concentration was much less. The average rate constant was 0.010 day^{-1} and varied among cows from 0.005 to 0.016 day^{-1}. The variation could not be related to such parameters as milk fat production or body weight change. Decline in concentration of PCB in body fat paralleled decline in concentration of PCB in milk fat. (Copyright 1972 - Journal of Agricultural and Food Chemistry)

4291-A6, A7, B1, C2
COLLECTION AND ANALYSIS OF ORGANIC GASES FROM NATURAL ECOSYSTEMS: APPLICATION TO POULTRY MANURE

Department of Agronomy, Cornell University, Ithaca, New York 14853
M. S. Smith, A. J. Francis, and J. M. Duxbury
Environmental Science and Technology, V. 11, No. 1, p. 51-55, Jan., 1977. 2 fig., 3 tab., 9 ref.

Keywords: Poultry manure, Gases, Odor, Volatile gases, Collection, Chemical analysis, Alcohols, Ketones, Esters, Carboxylic acids, Dimethyl sulfide, Dimethyl disulfide.

Combined gas chromatography-mass spectrometry was used to identify volatile compounds generated from chicken manure and collected in Poropak QS-Carbosieve B traps. Various alcohols, ketones, esters, and carboxylic acids together with dimethyl sulfide an dimethyl disulfide were detected when the wastes were incubated in an argon atmosphere. Significant amounts of dimethyl sulfide and dimethyl disulfide but few other compounds were found when the manure was incubated in air. (Copyright 1977-Environmental Science and Technology)

4292-E3
ENRICHED POULTRY MANURE AS A BALANCED FERTILIZER

Anonymous
Poultry Digest, V. 36, No. 425, p. 330, July, 1977.

Keywords: Caged layer manure, Chemicals, Fertilizers, Recycling, Canada.

According to studies conducted at Agriculture Canada Research Station, fresh cage layer manure (67 percent moisture content) with the addition of various chemicals, can be the basis for a well balanced all-purpose fertilizer. The latest formula consists of: 160 lbs. of fresh poultry manure from cages, 80 lbs. of peat moss containing no more than 50 percent moisture, 14 lbs. superphosphate, 7 lbs. powdered quick lime, 1.4 lbs. iron sulphate, 5 lbs. potassium sulphate, and 1 lb. Formaldagen. A mechanical mixer which removes feathers from the manure is used. The powdered quick lime is the last of the ingredients added. (Merryman-East Central)

4293-A11, B3, C2, D1, D3, E3, F1
FEEDLOT WASTE WORKS IN GROWING RATION TEST

Anonymous
Beef, V. 13, No. 5, p. 9, Jan., 1977. 1 tab.

Keywords: Feeds, Beef feedlot manure, Drying, Ensiling, Refeeding, Cattle, Performance, Economics.

Fort Valley (Georgia) State College studies of the feeding values of beef feedlot manure in 1 metabolism trial with steers and 1 feedlot trial with yearling heifers revealed cattle feedlot waste to make a good livestock feed. Cattle wastes were scraped from a feedlot with concrete floors. The wastes were collected from cattle fed 80 percent concentrate rations. The wastes were dried and mixed with ground corn and mineral-vitamin premix in the metabolism trial in order to provide a ration containing 10.5 percent protein. A similar ration containing 10.5 percent protein and utilizing cottonseed meal as the supplemental protein source was compared with the waste containing ration. When fed to steers, the cattle wastes had protein value equal to that of corn protein but only 60 percent of the protein value of cotton seed meal. Dry matter digestibility was 82 percent with the corn-cottonseed meal ration and 77 percent with the corn-cattle waste ration. About 40 percent of the manure protein was utilized by the steers during refeeding. In the heifer-feeding trial, a mixture of 60 percent cattle waste, 35 percent peanut hulls, and 5 percent ground corn was ensiled in an oxygen-limiting silo. Corn was added to stimulate proper fermentation. The resulting silage was fed free-choice to 24 heifers while another 24 heifers received coastal bermudagrass hay. All heifers received six pounds of a fortified grain mix per day. The heifers receiving the waste silage gained significantly slower, but the cost of gain was less with the waste silage diets. The waste silage cost about $11.00 per ton including handling and processing. (Merryman-East Central)

4294-A2, A6, B1, D1, D2, D3
FEEDLOT ODOR CONTROL RELIES ON DRY MANURE AND RAPID REMOVAL

Texas A&M University, College Station, Texas
J. M. Sweeten
Feedlot Management, V. 9, No. 6, p. 7-9, June, 1977. 2 tab.

Keywords: Odor control, Feedlots, Odor control chemicals, Waste management, Drainage, Agricultural runoff.

The 2 basic principles for controlling feedlot odors are: (1) Keep manure relatively dry as much of the time as possible, and (2) Keep a minimum amount of manure and wastewater on hand. Feedlot odor may be minimized by adhering to the following odor control strategies: (1) Maintain good surface drainage at uniform feedpen slopes of 1 percent (for dry areas) to 6 percent (for humid areas). (2) Collect only loose surface aerobic manure at frequent intervals of 3-6 weeks. (3) Use elevating scrapers or road graders for manure collection to leave a smooth pen surface. (4) Maintain a compacted anaerobic manure layer on the feedlot surface. (5) Dispose of dead animals within 24 hours. (6) De-water feedlot runoff retention ponds as quickly as possible. (7) Separate manure solids from feedlot runoff by constructing settling basins or channels and maintaining recommended pen slopes. (8) Treat feedlot surface with proven odor control chemicals/biochemicals when trouble spots develop. (Merryman-East Central)

4295-A6, B1, F2
STATE ODOR REGULATIONS

Anonymous
Feedlot Management, V. 9, No. 6, p. 7-8, June, 1977.

Keywords: Feedlots, Regulation, Nuisance suits, Odor, Legal aspects, Odor intensity standards, Scentometers.

Feedlots are subject to both public and private odor regulations. Private regulation comes through the common-law concept of nuisance which grants all persons the basic right to enjoy their property. Any unreasonable interference with enjoyment is legally a nuisance, subject to a civil lawsuit in all states. A feedlot owner can be successfully sued under the nuisance law even though he complies with public regulations and standards. Penalties may include an injunction and/or damages. State air pollution control agencies also regulate odors as a nuisance. Receipt of an odor complaint may trigger several enforcement steps. The complaint may be investigated and a public hearing may be held. The hearing examiner's conclusions often determine further agency action. The state agency may dismiss action against the feeder; recommend technical assistance to improve the situation; enter an administrative order requiring specific odor abatement measures; or refer the case to the state attorney general for litigation. Odors may also be regulated on the basis of state odor intensity standards in which odor threshold in surrounding air at the property line is measured on a scentometer. Most of the 8 states utilizing these odor intensity standards do not allow odor intensities in surrounding air to exceed 7 dilutions to threshold. A proposed Iowa Odorous Substances Control Act would refine the nuisance concept even further. An "actionable complaint" would exist only when 4 parameters are exceeded: odor frequency, duration, quality (offensiveness), and intensity. (Merryman-East Central)

4296-B1, C2, D3, E3
FARMERS AS FUEL SUPPLIERS

R. Gogerty
The Furrow, V. 82, No. 6, p. 2-4, July/Aug., 1977. 7 fig.

Keywords: Energy, Recycling, Biomass crops, Crop residues, Grain processing, Alcohol, *Euphoria tirucalli*, Manure, Fermentation.

Fred Benson, dean of Texas A&M University's engineering college, feels that "agriculture is a logical and renewable energy source." While we have the technical know-how to produce and harvest agricultural energy, we must still perfect the necessary processing and transportation technology. Researchers are finding a number of promising sources of energy. One of the most promising biomass crops for energy production is the hybrid poplar. A number of pilot projects for using biomass fuel are now under way. Ken Crookston and Dale Moss, University of Minnesota agronomists, are evaluating corn, winter rye, and cattails for biomass production. Glenn Huppke, a consulting chemical engineer from Land O'Lakes, Florida, feels that sunflowers also have potential as a biomass crop. Crop residues also have potential as an agricultural energy supply. There is also a possibility of processing grain to produce alcohol, which could supplement or replace gasoline. A more exotic fuel-crop possibility is the milk bush, 'Euphorbia tirucalli'. This plant produces latex, which contains hydrocarbons chemically similar to petroleum. Processing of latex produces a crude oil that can be further processed into fuel oil, gasoline, plastics, or fertilizer. Another potential farm energy source if the fermentation of organic wastes such as manure to produce methane. This is already being utilized by Calorific Recovery Anaerobic Process Inc. They are constructing a commercial methane plant near Guymon, Oklahoma for the purpose of supplying methane gas as an energy source. While some energy experts say the costs and inefficiencies of farm fuels make them high-priced compared with fossil fuels, others say we can't spare land for fuel production because we need it to produce food and still others worry about using crop residues for energy instead of soil conditioning, it would still seem that agricultural sources of energy may be the promise of the future. (Merryman-East Central)

4297-B1, C1, C2, D2, D3, E3, F1
ENERGY FROM FEEDLOT MANURE

Texas Agricultural Extension Service, Texas A&M University, College Station, Texas 77843
J. M. Sweeten
Agricultural Engineering, AENG 6, Texas Agricultural Extension Service, Oct. 21, 1974, 4 p. 1 tab., 7 ref.

Keywords: Energy, Recycling, Feedlot manure, Fertilizers, Refeeding, Combustion, Gasification, Anhydrous ammonia, Costs.

The amount of manure produced in Texas feedlots may at times seem ominous, but placed in perspective it could have only a minor impact on the overall energy of fertilizer picture statewide. At those localities where feedlot manure is available, however, it should continue to be put to good advantage in combatting both spiraling costs and agricultural energy consumption. Indications are that 8 times more energy could be saved by refeeding manure to feedlot cattle than from land application. However, unless stocker or range cattle markets for feedlot manure can be created, refeeding offers little promise as a method of ultimate manure disposal. (Sweeten-Texas A&M University)

4298-A1, B1, F2

TOWARD THE DESIGN AND MANAGEMENT OF ENVIRONMENTAL SYSTEMS

Department of Electrical Engineering and Systems Science, Michigan State University, East Lansing, Michigan 48823
H. W. Koenig, W. E. Cooper, and J. M. Falvey
Paper No. 71-581, American Society of Agricultural Engineers, 1971 Winter Meeting, Chicago, Illinois, Dec. 7-10, 1971, 43 p. 7 ref.

Keywords: Design, Management, Ecology, Industry, Agriculture, Economy, Pollution, Pumping, Regulation, Population control.

An industrialized ecosystem is conceptualized as a material-processing "machine" driven by solar, human and physical forms of energy. Long-range planning is defined as a problem in the design of the material-processing machine; management as a problem in regulating the development of the landscape toward an environmentally secure design target. Design and management policies are discussed. (Koenig-Michigan State University)

4299-B1, E3, F1

ENERGY AND RESOURCE REQUIREMENTS FOR BEEF CATTLE PRODUCTION

Department of Animal Science, Colorado State University, Fort Collins, Colorado
G. M. Ward
Feedstuffs, V. 48, No. 52, p. 16, 18, Dec. 20, 1976. 6 tab., 6 ref.

Keywords: Cattle production, Feeds, Economics, Forages, Grains, Refeeding, Poultry wastes, Cattle wastes.

Beef cattle production has increased dramatically in this country since 1940. Beef production is usually divided into 3 segments: cow-calf; stocker, or the growing phase; and the finishing phase, usually in the feedlot. The cow-calf operation has been an inherently low-return type of agriculture utilizing feeds having little market value for other purposes. On the other hand, in the finishing phase there are strong economic incentives to increase the quality of feed because one-third to one-half of the feed is required for animal maintenance. The more feed consumed per day, the fewer days on feed that are necessary, resulting in lower overhead costs. Where did additional feed resources come from? About one-half of the grazing needs was obtained by reducing other species of animals, ie. sheep, horses, etc. Another agricultural change that provided grazing was abandoned cropland that was subject to severe erosion or unsuitable for mechanized farming. Feed grains to support the increase in cattle feeding were produced from a declining number of acres because of remarkable increases in production per acre. If cattle production continues to increase, the future doesn't look too promising for extra feed sources. Feed grain supplies seem likely to decline due to demand from the export market. Feed supplies are not likely to be released by further massive declines in other grazing animals. Dairy cattle and sheep are probably somewhere near minimum while horses are on the increase again. The best pasture lands are being converted to crops. The most productive forages - corn silage and alfalfa - are in direct competition for land. One feed source that is receiving greater attention is crop residues -- especially corn stalks and straw. However, the largest sources of these materials are in areas where there are few cattle and almost no fences. Another largely unexploited source of nutrients is manure. The feed value of poultry manure has been clearly established. Cattle manure, for the most part, requires some processing either as silage, or physical and chemical treatment to separate the fiber and ash from the higher protein and more digestible fractions. Regulations and prejudice have restrained the refeeding of manure, but changes are making refeeding more acceptable. (Rowe - East Central)

4300-B1, C1, C2, D1, E3, F1

RE-CYCLING IS NO CURE-ALL

Anonymous
Beef, V. 13, No. 11, p. 18-19, July, 1977. 1 fig.

Keywords: Refeeding, Feedlot wastes, Cattle, Performance, Economics, Nutrients.

At 2 recent cattle feeding seminars, researchers took a hard look at the problems and benefits of refeeding animal wastes. They found that nutritional value of recycled manure varies tremendously due to: (1) original ration fed, (2) nutrient losses incurred during storage and handling, and (3) amount of dirt in the manure. It was not felt that refeeding was likely to make a big cut in cost of grain. Results from a number of studies cited seemed to yield the following conclusions concerning refeeding manure: (1) The refeeding value of such waste material is substantially lower than many people have speculated. Waste material would have to be regarded as a low quality feed, which would have best use in maintenance or low-energy type diets. Some potential may exist for limited use in growing rations, but there seems to be little or no justification for using manure in feedlot diets, except under unusual circumstances. (2) Recycling won't get rid of the manure problem. Only about half of the manure from cattle on finishing rations can be recycled. The rest would have to be disposed of some other way. Also, only about one-fourth of the original dry matter can be obtained after putting the material through 4 recycles. (Bates - East Central)

4301-B3, C1, C2, D3, E3

NUTRITIVE VALUE OF ENSILED BROILER LITTER

Agricultural Experiment Station, University of Arkansas, Fayetteville, Arkansas 72701
M. S. Smith and L. B. Daniels
Arkansas Farm Research, V. 26, No. 3, p. 16, May-June, 1977. 1 tab.

Keywords: Refeeding, Litters, Ensiling, Moisture content, pH, Crude protein, Dry matter digestibility.

Nutritive research was conducted at the University of Arkansas Agricultural Experiment Station to determine the feeding value of ensiled broiler litter. Broiler litter with either a rice-hull (RH) or wheat-straw (WS) base was ensiled at 40 and 50 percent moisture levels in 30-gallon garbage cans lined with plastic bags. In one treatment of the RH and WS silages, water was used to bring the litter to the desired moisture level; liquid cheese whey (2/3 litter to 1/3 whey by weight) was used in the other treatment. Also a mixture of wheat-straw litter and ground corn (2/3 litter to 1/3 corn) was ensiled at the 40 percent moisture level. Two batches of broilers had been raised on these litters. Preliminary results suggested that broiler litter can be ensiled, but that a carbohydrate source should be added to insure proper ensiling. (Bates-East Central)

4302-B1, E2, F1

DIVERSIFY--BUT STAY EFFICIENT, SAYS IOWA CATTLE FEEDER

Beef editor
P. D. Andre
Beef, V. 13, No. 7, p. 58, 60, March, 1977. 4 fig.

Keywords: Management, Confinement pens, Design, Cattle, Economics, Slotted floors, Land spreading.

Robert F. McDowell is currently involved in keeping 1,500 cattle on feed at all times, growing 2,400 acres of corn, maintaining a flock of 25,000 caged layers and growing their replacements in renovated turkey buildings. Mr. McDowell's management philosophy is "maximize the optimum". In trying to achieve this in his cattle management, Mr. McDowell settled on the following design for his confinement pen. He built an open front building with doors in the back that could be opened for summer ventilation. The building is 50 feet wide, 330 feet long, and pen width varies from 20 to 50 feet wide. A 14-foot feed alley runs the length of the building. Mr. McDowell allows 18 square feet per animal, based on 1,000-pound steers. Gains run about 2.8 pounds/day. When Mr. McDowell erected the building, he made optimum use of his available labor by pouring the 4 x 10-foot slats on an almost daily basis during the summer, as other work permitted. The slats rest on the cross walls of the pits and one section of slats is only 2 feet wide, making it easy to lift out so a chopper pump can be put into the pit. The fact that McDowell has a number of individual pits allows him to stir and haul wastes at times when there is only a short amount of time to be spared for this activity. The fact that McDowell has various sizes of pens allows him to optimize his marketing. The front pen always contains a load of cattle that are ready for sale. This way buyers always know which cattle are for sale. This arrangement also makes loading easy. (Rowe-East Central)

4303-A1, B1, C2, D3, E3, F1
METHANE POWER! THE PLOWBOY INTERVIEW

Anonymous
The Mother Earth News, Mother's Reprint No. 102, 1972, 4 p. 6 fig.

Keywords: Recycling, Methane, Organic wastes, Digesters, Design, Economics, Temperature, Carbon, Nitrogen.

Ram Bux Singh of India has studied ways to recycle waste into non-polluting fuel. He was appointed by India to simplify the construction of bio-gas plants. The bio-gas plant has been made economical for small farms. Laboratory tests show that the fertilizer which comes from a bio-gas plant contains three times more nitrogen than the best compost through open air digestion. Tests with human excreta have not been successful because there is too much water with the excreta--too much liquid for the digesters to handle. All material must be analyzed before being put into a bio-gas plant. The ratio of carbon to nitrogen in the material must be calculated. In 40 days the material will produce 95 percent of the gas it is capable of producing, when a digester loaded with the proper (30-to-1) carbon-nitrogen mixture is maintained at 90-95 F. Below 50 or 60 the whole process is stopped. Above 118 , the bacteria will die. The bio-gas plants designed for the digestion of material are either ''batch feeding'' and ''continuous feeding''. For the batch cycle, a bio-gas tank is opened and filled with the waste material to be processed. Then after 40 days the fertilizer is taken out and the tank is filled again for another cycle. With the continuous feeding method, a bio-gas plant tank is opened and filled with the waste material to be processed. Then after 40 days the fertilizer is taken out and the tank is filled again for another cycle. With the continuous feeding method, a bio-gas plant is filled once. Then, undigested matter in the amount of one-fortieth of the volume of the tank is added each day, as the bacteria inside begin to change the waste into methane and fertilizer. In order for the manure and waste to digest at the proper time it must be warmed and stirred uniformly. The methane from a bio-gas plant is only about half as efficient as the natural gas we buy in the United States. There is much potential energy which goes to waste in cities in the United States. Ram Bux Singh wants to develop a bio-gas plant for the United States that people can buy and install and put into use quite easily. (Rowe-East Central)

4304-A9, A10, B1, D2
TOXICITY OF SD 8447 AND DICHLORVOS TO LARVAE OF THE HORN FLY, *HAEMATOBIA IRRITANS*, (DIPTERA: MUSCIDAE) IN MANURE OF INSECTICIDE-FED CATTLE

Department of Entomology and Nematology, University of Florida, Gainesville, Florida
J. F. Butler and N. I. Greer
Florida Entomologist, V. 56, No. 2, p. 103-105, 1973. 1 tab., 12 ref.

Keywords: Feed additives, Insecticides, Cattle, Fly control.

SD 8447 (2-chloro-1-(2, 4, 5-trichlorophenyl) vinyl dimethyl phosphate) used as a feed additive for cattle caused significant (p$<$.01) mortality of horn fly, *Haematobia irritans* (Linnaeus), larvae in manure samples from cattle. At levels of u.1, 0.15, and 0.20 mg/kg/day, the percent mortality was respectively 63, 85, and 97.6. Similarly dichlorvos pellets (Atgard™) fed at 2.25 mg/kg/day produced 98.3 percent mortality, while 7.2 mg added to 100g manure from untreated animals results in 99 percent mortality (p$<$.01) of horn fly larvae. (Copyright 1973-Florida Entomologist)

4305-B1, C2, D2, E3
CONVERSION OF BOVINE MANURE TO OIL

Pittsburgh Energy Research Center, U. S. Department of the Interior, Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, Pennsylvania 15213
Y. C. Fu, S. J. Metlin, E. G. Illig, and I. Wender
General Papers and Symposium on Environmental Pollution Control. Part I. The Energy Situation and its Environmental Impact, V. 17, No. 1. 164th National Meeting, American Chemical Society, Division of Fuel Chemistry, New York, New York, Aug. 27-Sept. 1, 1972, p. 37-43. 2 fig., 5 tab., 4 ref.

Keywords: Recycling, Cattle manure, Carbon monoxide, Water, Waste treatment.

The conversion of manure to oil with carbon monoxide and water was studied. Three sources of bovine manure were used in temperatures from 300° to 400° C. The pressure ranged from 2400 to 5300 psi. To determine the amounts of the oil and residue in heavy oil products, the residue was separated from water and extracted by benzene. Gaseous products were analyzed by mass spectrometry. In an attempt to improve oil yield and hydrogen utilization, hydrogenation catalysts were used in place of carbon monoxide in tests using hydrogen or synthesis gas (H_2:CO = 0.9:0). This shows that instead of carbon monoxide, synthesis gas can be used to convert manure to oil in reasonably good yield. By using water:manure ratio as low as 0.25:1 with a suitable high boiling vehicle, improvements such as low operating pressure and less energy requirements were achieved. (Rowe-East Central)

4306-A8, B2, B3, B5, C2, E2
AN EVALUATION OF FARMYARD SLURRY ENRICHED WITH EITHER POULTRY MANURE OR INORGANIC N-P-K AS FERTILIZER FOR PERENNIAL RYEGRASS

Pye Research Centre, Haughley, Suffolk, England
M. C. Cowan
Plant & Soil, V. 45, No. 3, p. 625-636, Dec., 1976. 6 fig., 6 ref.

Keywords: Rye grass, Fertilizers, Crop response, Poultry manure, Slurries, Fertilizers, Nitrogen, Phosphorus, Potassium, Sodium, Magnesium, Temperature, Soil chemistry.

Experiments were conducted to evaluate poultry manure as a source of available nitrogen in soil, and to compare levels of available nitrogen, phosphorus, and potassium in soil to which inorganic fertilizer or poultry manure were applied, either alone, or together with slurry. The effects of these soil applications on growth, and levels of phosphorus (P), potassium (K), sodium (Na) and magnesium (Mg) in shoots of *Lolium perenne* grass were measured. Experiments were performed under 2 sets of environmental conditions, intended to approximate summer or winter temperatures. Under conditions of low temperature and retarded growth, the best overall advantage in terms of dry matter yield and levels of P, K, Na and Mg in *Lolium perenne*, was gained by use of inorganic fertilizer alone. The application of poultry manure in combination with slurry resulted in better dry matter than was achieved through poultry manure alone. It was found that, under conditions of high temperature and rapid growth, a combined application of slurry with inorganic fertilizer could bring, in addition to an economic benefit, a small but significant improvement in the quantities of P and K in the herbage. The effects of the treatments on plant nutrient levels were not readily related to the effects on the available levels in the soil. Generally the addition of poultry manure, with or without slurry, resulted in increased amounts of available Na, K, and Mg in the soil, probably due to the large amounts of these elements contained in poultry manure. (Merryman-East Central)

4307-A11, E3, F2
AAFCO TASKFORCE WORKS ON ANIMAL WASTE REGULATIONS

Feedstuffs, Staff Editor
J. D. Kendall
Feedstuffs, V. 49, No. 22, p. 5, 39, May 30, 1977.

Keywords: Refeeding, Regulation, Antibiotics, Feed additives, Labeling, Heavy metals.

James Minyard, a Mississippi state chemist, presented a preliminary report concerning model regulations for animal waste feeds at the annual American Feed Manufacturers Association (AFMA) convention. Minyard stated that model regulations for animal waste feeds are being drawn up by a taskforce of the Association of American Feed Control Officials (AFFCO) and should be ready after the AAFCO's annual meeting the first week in August. The taskforce is drawing up a uniform regulation regarding waste feeds. The 2 strategies being pursued are: (1) to draw up a very broad set of regulations that incorporate the general regulations that the states now permitting waste feeding have in common and (2) to draw up a set of specific regulations with lines of regulatory authority and very specific language detailing the whole concept of animal waste feeds and feeding. Other preliminary reports presented during the AFMA convention by AAFCO officials included those given by: The Medicated Feed Committee, Pet Food Committee, Uniform Feed Bill and Regulations Committee, Silage Additive Taskforce, Miscellaneous and Special Purpose Products Committee, Mineral Investigation Committee, Feed Nomenclature Committee, Uniform Forms Committee and State-Industry Relations Committee. AAFCO also announced that a series of AAFCO/Food & Drug Administration training sessions to discuss the new revised Good Manufacturing Practice Regulations have been tentatively scheduled. (Bates-East Central)

4308-A11, C2
SYNTHESIS AND STABILITY OF DIMETHYLNITROSAMINE IN CATTLE MANURE

U. S. Department of Agriculture, Ft. Collins, Colorado 80522
A. R. Mosier and S. Torbit
Journal of Environmental Quality, V. 5, No. 4, p. 465-468, Oct.-Dec., 1976. 7 tab., 18 ref.

Keywords: Nitrosamines, Feedlots, Cattle manure, Manure packs, Aerobic conditions, Anaerobic conditions.

A study was conducted to determine if N-nitrosamines, compounds that are carcinogenic to laboratory test animals and possibly to man, are synthesized from the N-compounds found in beef cattle feedlots. More specifically the objectives of the study were (1) to determine if N-dimethylnitrosamine (DMNA) and N-diethylnitrosamine (DENA) could be detected in cattle manure packs; (2) to identify and quantify nitrosamine precursors; (3) to determine whether DMNA could be synthesized from dimethylamine (DMA) and nitrite (NO^{-}) in manure; (4) to determine DMNA's stability in manures under aerobic and anaerobic conditions. It was found that the necessary precursors are present in manures but that the requirements for sustained production of DMNA in the manure pack probably, do not exist. Neither DMNA or DENA was found at minimum detection limits of 0.02 ppm in manure. Aerobic incubation of manure with DMA-N (500 ppm) plus NO$_2^-$ - N (1,000 ppm) generates detectable DMNA, but DMNA was not detected in samples incubated anaerobically or with lower levels of precursors. DMNA was stable in sewage effluent, and in manure and manure extracts held under both anaerobic and aerobic conditions. (Bates-East Central)

4309-E3
FOOD WASTE, MANURE HOLD PROMISE AS FEED, VETERINARIANS TOLD

Feedstuffs, Staff Editor
J. D. Kendall
Feedstuffs, V. 49, No. 29, p. 6, July 18, 1977.

Keywords: Feeds, Refeeding, Food wastes, Manure.

Food wastes and manure were advocated as good sources of livestock feed by speakers at the scientific sessions of the American Veterinary Medical Association 1977 annual meeting. Dr. T. W. Powell, University of Georgia extension veterinarian, estimated that 80-100 million tons of food waste are generated in the United States each year--mostly by mass food establishments and food processing plants. Of this total, 60-75 percent can be used as feedstuffs. A food waste processing system conducted experimentally by the University of Georgia at the Ft. Benning, Georgia army base can produce an end product that is more versatile than unprocessed wastes and that can be fed to species other than swine, which is where most unprocessed food wastes are fed. The total processing and collection costs are about $80-$95 per ton for the experimental product. Dr. Brady Anthony, an Auburn University animal scientist, stated that 2 billion tons of livestock wastes are generated each year. He stated that Auburn trials have shown that blending manure with other ingredients and storing the product as silage seems to be the most feasible approach. He added that recycled manure can theoretically be recycled forever, since undesirable residues don't seem to increase noticably. Sam B. Hay, a Covington, Georgia cattle producer, said that he has been feeding silage containing manure to his cattle for 6 years and has found that he has saved 15-20 percent over conventional feeding systems. (Merryman-East Central)

4310-A2, A4, A5, A6, A8, B1, D3, E2, F3, F4
LIVESTOCK WASTE MANAGEMENT - STATE OF THE ART

C. B. Gilbertson
Report presented at the request of the Institute of Environmental Quality, State of Illinois, Carbondale, Illinois, and entered as testimony in the State of Illinois Public Hearing Minutes, February 1, 1973, 9 p. 14 ref.

Keywords: Waste management, Feedlots, Livestock, Cattle, Nebraska, Odor, Agricultural runoff, Water pollution, Groundwater pollution, Soil pollution, Land application, Application rates, Overland flow.

An overview of livestock waste management problems and research results is presented. Beef cattle on outdoor feedlots are particularly considered. The report is based on results derived from research initiated in 1968 on beef cattle feedlots located in Nebraska and from the author's personal experience. The report includes a brief description of beef cattle feedlots, the quantity and quality of feedlot runoff, groundwater and soil pollution potential, and methods of runoff control. The author feels that research is still required to determine: (1) Alternative systems to relieve odors from livestock operations (outdoor and housed feedlots), (2) Alternatives for debris basin cleaning or management, (3) Recommended land application rates of liquids and solids that will not have long-term, adverse effects on soil, groundwater, and crops, (4) Effect of ration on runoff quantity and quality, (5) Effect of distance of overland flow, topography, and vegetative cover on pollution characteristics of feedlot runoff, and (6) Materials handling and processing component design for alternate methods of utilization of animal wastes other than land disposal. (Merryman-East Central)

4311-D2, E3, E4, F1
IMAGINE YOUR FEEDLOT MANURE CAN POWER YOUR MILL AND BRING CASH FROM SALE OF EXCESS POWER!

Anonymous
Calf News, V. 8, No. 11, p. 42, 45, Nov., 1970. 4 fig.

Keywords: Recycling, Feedlot wastes, Combustion power unit, Energy, Fuels, Economics, Feed supplements, Fertilizers, Building blocks, By-product recovery.

An interview with R. G. Reese, general manager of a firm which is now developing a 400-ton-a-day combustion power unit for a solid waste incinerator for communities, has revealed that the Department of Health, Education and Welfare has funded the money for continued research and the construction of a one-tenth-size model. A feedlot with 8,000 cattle could utilize a 40-ton-a-day unit for waste processing. Unit and installment price would be about a quarter of a million dollars. To start the combustor, auxiliary fuel is used but once started the manure becomes the fuel. For feedlots with slotted floors a tank is usually used to collect the manure. From such a tank, the manure could be moved by vacuum into the combustion power unit. The combustor is all automatic and labor free. A by-product of the combustion process is ash. This has value as either a fertilizer if nitrogen is added, or as a feed ingredient because it has potassium and phosphates, or as a construction block when a binder is added, or as a land fill. A 40-ton-a-day unit will produce about 1,000 kilowatts of energy. This is more than adequate to run a mill, supply all necessary electricity and still have some to sell. Availability of a 40-ton-a-day unit for feedlot trial is about 2 years off. (Merryman-East Central)

4312-B1, B3, F1
FEEDLOT MANURE COLLECTION EFFICIENCY

Anonymous
Agricultural Engineering Newsletter, V. 2, No. 5, p. 1-2, May, 1976.

Keywords: Manure collection, Feedlots, Time-motion studies, Elevating scraper, Wheel loader, Wheel loader/chisel plow, Machine productivity, Energy consumption, Costs.

Time-motion analysis was used to compare 3 systems [elevating scraper, wheel loader, and wheel loader/chisel plow (or rototiller) combination] on the basis of machine productivity (tons/hour), energy consumption (tons/hp-hr) and cost ($/ton). Results were adjusted to 100 percent time efficiency (60 working minutes/hour) to allow comparisons. The elevating scraper proved 25-75 percent more efficient in energy consumption than systems involving wheel loaders. For wheel loader systems, use of a chisel plow or rototiller to break up the manure pack cut energy consumption 30-40 percent. Cost comparisons showed about the same collection cost (16 to 17¢/ton) for both the elevating scraper and the wheel loader/chisel plow-rototiller combination. However, collection with the wheel loader alone cost 25 percent more than the other 2 methods. The elevating scraper gave a consistently high manure collection rate of 175 tons/hour, which was matched on the average by the wheel loader/chisel plow combination (176 tons/hour). But a small wheel loader preceded by a rototiller only collected 117 tons/hour. With no prior surface preparation, a large wheel loader could achieve a collection rate of only 118 tons/hour. The process of loading stacked manure into spreader trucks with wheel loaders was also studied. Measured truck loading rates ranged from 160 to 280 tons/hour, with an average rate of 205 tons/hour. The calculated cost of truck loading ranged from 8 to 14¢/ton. (Merryman-East Central)

4313-B3, C2, E3, F1, F2
DPW VALUE AS ANIMAL FEED SEEN REACHING $100 A TON

Feedstuffs, Southeastern Correspondent
R. H. Brown
Feedstuffs, V. 47, No. 17, p. 6, 74, April 25, 1975.

Keywords: Refeeding, Dried poultry litter, Fertilizers, Economics, Legal aspects.

The Georgia Cooperative Extension Service, the Georgia Poultry Federation, and the Georgia Cattlemen's Association sponsored a symposium concerning recycling dried poultry litter into cattle feed. While poultry litter has been found to have a value of between $20 and $25 a ton as plant food, as a feed for ruminants it is estimated that litter will range from a low of $4 to a high of $100 a ton. As an animal feed, the litter has substantial nutritional value, being high in crude protein, while the nitrogen can be efficiently utilized by ruminants. Much of the future of refeeding dried poultry litter depends on when and if the Food & Drug Administration issues its much-discussed and much-delayed proposal on the use of recycled animal waste as a feed ingredient. However, it is known that some cattlemen are already recycling for intrastate feeding and there is already developing a fairly strong demand for litter. Two states have taken steps to speed up recycling. Mississippi's Commissioner of Agriculture Jim Buck Ross announced he is moving toward approval and California has already approved refeeding. (Merryman-East Central)

4314-A11, A12, B1, C2, C3, D2, D3, E3
MORE ON MANURE

Anonymous
Feedlot Management, V. 19, No. 7, p. 4, July, 1977.

Keywords: Refeeding, Performance, Copper, Iron, Calcium, Amprolium, Pathogenic bacteria, Fermentation, Chemical treatment.

One estimate cites as many as 2 percent of today's cattle on feed as receiving manure-containing feedstuffs. The major concern about refeeding is transfer and accumulation of chemical residues. The best safeguards are: (1) avoid feeding manure that contains potential chemical contaminants, or (2) if residues are present, allow at least 2 weeks withdrawal time prior to slaughter. U. S. Department of Agriculture feeding trials have indicated that a 6-day withdrawal period is sufficient to decrease tissue levels of arsenic from recycling manure. In one study, caged layer manure fed to steers at 12 percent of the diet caused increased copper levels in liver tissues, higher iron levels in kidneys and reduced levels of cadmium in kidney tissues. In another study, residues of amprolium in broiler litter did not cause elevated tissue concentrations after 5-day withdrawal time when steers were fed up to 50 percent litter ration. Processing to destroy pathogens may be accomplished by either fermentation or treatment with chemical preservatives. (Merryman-East Central)

4315-A8, A12, B2, B3, B5, E2, E3
WASTE DISPOSAL IN FORESTS

J. Shoemyen and M. Cillev
Sunshine State Agricultural Research Report, V. 21, No. 2, 3, & 4, p. 6-8, Fall, 1976. 1 fig., 2 tab.

Keywords: Waste disposal, Forest lands, Crop lands, Tree response, Wastewater irrigation, Composted wastes, Health hazards.

Dr. Wayne H. Smith, professor in the IFAS School of Forest Resources and Conservation, is working with James O. Evans of the U. S. Forest Service in compiling information on waste disposal in forests. Disadvantages of using human and animal wastes on croplands are cited. Application of waste materials to forest land instead may offer a number of advantages from the standpoint of safe waste disposal. Since waste disposal systems need to operate year-round, forests are better sites than agricultural lands where seasonal crops are grown. Not only do the forest soils have greater capability to absorb water and fix phosphorus, they also do not freeze during cold weather like cultivated soils. Also, forest land owners and managers can obtain greatly accelerated growth of some trees through application of waste nutrients. Increased production of wood can, in turn, help meet the nation's need for energy and industrial materials. Except for the Great Plains and the southwestern regions of the United States, forest lands are abundant, well distributed, and occur near major areas where wastes are generated. Work is needed to determine what levels of wastewater irrigation will give good response from tree growth and will provide for adequate renovation of the wastewater, without doing any harm to the forest land. A California study showed that effluent was needed at rates of 7.6 cm or more per week for benefits to accrue. Upper limits of wastewater irrigation will depend on such things as species of tree, growth stage of forest, and type of soil. Another waste disposal possibility is the incorporation of composted solid wastes into woodland soils. Wastes may also be useful in nursery production. A landowner who has both animal operations and woodlands may find it practical to apply animal wastes to forest strips. Difficulties that arise in utilizing forest lands for waste disposal include unavailability of access roads and sloped rugged contours of the land. (Merryman-East Central)

4316-B1, C2, E2, E3
WHAT'S MANURE WORTH AS A FERTILIZER?

Anonymous
Wallaces Farmer, V. 101, No. 23, p. 21, Dec., 1976.

Keywords: Livestock wastes, Manure production rate, Fertilizer values.

Approximate annual manure production per 1000 lb. animal weight is for a dairy cow, 15 tons; beef feeder, 11 tons; swine feeder, 12 tons; gestating sow, 6 tons; and sheep feeder, 7.3 tons. These figures can be used to estimate total manure production for different sizes and numbers of animals. The fertilizer value of manure, allowing for nutrient losses from handling and land application, may be estimated for use in planning. Again, for 1000 lb. animal units, the nutrients available annually in a manure pack are: dairy cow, 91 lb. N, 50 lb. P_2O_5, and 112 lb. K_2O; beef, 77 lb. N, 77 lb. P_2O_5, and 99 lb. K_2O; swine, 102 lb. N, 107 lb. P_2O_5, and 124 lb. K_2O. These values assume spreading and incorporation into the soil. Also values would differ for an open lot or manure pit. (Merryman-East Central)

4317-A8, B2, B5, C2, D1, D3, E2, F1
WASTE CONTROL CUT HIS FERTILIZER BILL IN HALF

Anonymous
Western Dairy Journal, V. 33, No. 4, p. 26, Feb., 1977. 1 fig.

Keywords: Dairy wastes, Waste treatment, Controliner, Anaerobic conditions, Agitation, Liquid wastes, Fertilizers, Land disposal, Crop response, Corn, Alfalfa, Economics.

Due to tightening waste control restrictions on dairies in the West, Morris Kaehler, of Lodi, California, installed a Controliner on his dairy which has turned his waste collection pit into a large "septic tank". The Controliner consists of a flexible bottom pit liner and a floating cover. An agitator was also added to speed the bacterial breakdown process which takes place within. Manure and runoff water from Kaehler's free stalls and milking barn enters the pit via a collection basin through a 10 inch plastic pipe. After a minimum of several weeks decomposition, the concentrated nitrogen-rich liquid is ready for removal—either by pipeline or truck. Advantages of the system are: (1) The liner keeps the smells in. (2) The system is very convenient. (3) The system provides a valuable fertilizer product that can cut Kaehler's fertilizer bill in half. The wastes are applied on alfalfa fields between cuttings. They are also applied to Kaehler's corn—with very good results. It is estimated that a gallon of the fertilizing liquid, after 15-30 days decomposition is worth on the average of 2 cents in nitrogen rich fertilizer. This would make each 250,000 gallon load be worth $5000. The fertilizer value is variable according to the soil conditions, but the value in California during hot summer months is hard to beat. (Merryman-East Central)

4318-A4, A6, B2, C2, C3, D3, E3
METHANE PRODUCTION FROM CATTLE WASTES

Department of Dairy Science, University of Illinois, Urbana, Illinois 61801
V. H. Varel, H. R. Isaacson, R. A. Frobish, and M. P. Bryant
Illinois Research, V. 18, No. 4, p. 10-11, Autumn, 1976.

Keywords: Recycling, Feedlots, Cattle wastes, Dairy wastes, Fermentation, Temperature, Retention time, Methane, Fertilizers, Refeeding.

The solid waste produced annually by farm animals in the United States is about 2 billion tons. About half of it is generated by intensive animal production systems, creating serious problems of disposal, odor control, and prevention of stream pollution. Bacterial conversion of this waste would offer partial solutions to these problems as well as supplement our supply of natural gas. Consequently, studies have been conducted at the University of Illinois on this process. Initially, the fermentation of cattle wastes was studied in small, 3-liter reactors. Once established, and with daily feeding, the fermentation of feedlot waste was found quite stable within a temperature range of 130° to 140°F and a range of 3-15 days in retention time for the reactor contents. Methane was produced most rapidly at 140°F. The gas produced had a relatively constant methane content of 55-58 percent, the rest being chiefly carbon dioxide. Reactors were established at different retention times (3, 6, 9, and 12 days) with a relatively low concentration of waste organic matter in water. Experiments were then done to measure the efficiency of methane production with increasing concentrations of waste. Efficiency was greatest in reactors receiving about 8 percent organic matter and set at the 3-day retention time. Other studies determined that dairy wastes are not as efficiently converted into methane as those from feedlot cattle. Because cattle wastes are high in ammonia and other minerals, they can be fermented in combination with materials such as municipal refuse, which are deficient in the minerals necessary for bacterial growth. Because of lowered organic matter, the effluent should be more valuable as a fertilizer than the original feedlot waste. Another possible use of the effluent is to remove the bacterial cells before disposing of the fluids. Since protein constitutes 50-60 percent of the dry matter in these cells, they could be fed to nonruminant livestock as a protein source. The thermophilic temperatures should have killed most of the pathogenic organisms. Evaluation of such cells as protein sources for chicks is now under study. The kinetics of bacterial growth are still under study. Also, the chemical composition of different organic materials is being studied in relation to the efficiency of methane production. (Merryman-East Central)

4319-A8, A11, A12, B1, C2, E2, E3, F1
STORIES MANURE CAN TELL

J. Goldstein
Organic Gardening and Farming, V. 23, No. 7, p. 92-96, July, 1976. 4 fig.

Keywords: Animal wastes, Refeeding, Land disposal, Recycling, Feedlots, Copper toxicity, Drug residues, Locating, Organic farming, Economics.

Manure may be used as a fairly accurate mirror to reflect what we are doing well and what we are not doing well in food production. Use of such food additives as copper and medicinal drugs may make animal wastes unsuitable for refeeding. Production of animals in such concentrated areas as feedlots and away from suitable land application areas, refeeding facilities, or recycling facilities constitutes another problem. These problems are getting so intense that one research study after another is citing the need to "break up the animal factories". Operators of large livestock production units are interested in disposing of high rates of animal wastes at minimal expense while some scientists are concerned about the effect of these rates on the environment. Harmful effects from large accumulations of manure on cropland include: (1) high total dissolved salts in soil, (2) nutrient imbalance, (3) excessive nitrate accumulations in the plants and nitrate leaching into groundwater, and (4) plants low in magnesium resulting in forages deficient in magnesium content for adequate nutrition. Organic farmers in the midwestern U. S. are making better use of manure than conventional farmers. Average manure-spreading rate on organic farms is 8 tons/acre compared to 6 tons/acre on conventional farms. Organic farmers have provided additional plant nutrients through crop rotations involving nitrogen-fixing legumes such as alfalfa or clover. The net result has been that conventional farms use almost 3 times as much for fertilizer, as the organic farms in producing $1 worth of crops. The message from all this seems to be: Diversify the sources of manure and improve its quality. Just like our food, we're better off when manure is produced closer to our homes and when it contains fewer additives. Manure is basic to organic gardening techniques. It is also a key ingredient for earthworm pits. (Bates-East Central)

4320-B1, F1
SEMI-CONFINEMENT AT 1/3 THE COST

Feedlot Management, Staff Editor
G. Lamp
Feedlot Management, V. 19, No. 7, p. 8-10, July, 1977. 3 fig.

Keywords: Semi-confinement, Cattle, Costs, Weather, Waste management.

Tom Prinz, who has a 2,100-head capacity semi-confinement feedlot near West Point, Nebraska, has been so satisfied with his semi-confinement barn that he hopes to build an additional 125 ft. very soon. Prinz chose this type of system in an effort to fight weather conditions with a minimal cost. The barn is a 325 ft. x 50 ft. x 12 ft. structure which is an open front protective barn specifically designed to protect cattle during feeding from typical Nebraska weather. The shaded confinement can comfortably handle nearly 600-head on full feed. Although the barn has a 6 in. slope from the alleyway to the open side, it still requires regular waste management. During the winter when cattle tend to remain inside longer, pens have to be scraped as often as every 2 weeks. During the summer, Prinz can sometimes get by with scraping pens only a couple of times. The slope of the barn's cement floor allows the liquid manure to drain out of the barn, over the lot and to a diversion area. The diversion area catches the drainage and lets solids settle. Additional liquid runoff continues on over a field and supplies a fertilizer base. When the initial barn was built in 1971, it cost $21,700 -- about 1/3 of what a confinement unit then cost. (Merryman-East Central)

4321-B1
WASTE HANDLING: WHICH MANURE MOVING SYSTEM FOR YOU?

Anonymous
Dairy Herd Management, V. 14, No. 1, p. 28, 30, 32, 34, 36, 38, Jan., 1977. 2 fig.

Keywords: Dairy industry, Management, Manure moving systems.

Selection of a dairy housing system is based upon local climate, terrain, tradition, and personal likes and dislikes. Once a housing system is selected, the manure handling system should be considered. If the logical manure handling systems are not suitable for the area, then it should be decided whether changes in the cow management system are acceptable. The problem of odor production must also be considered. The following manure moving systems are described: (1) The mechanical gutter cleaner or conveyor--a common transferring device. It can be used separately as in a stanchion barn or as part of a more complex system. (2) Tractor mounted blades, scrapers or buckets--equipment used for cleaning free stall alleys, concrete feedlots, and dirt exercise yards. They also can be used to clean out properly designed pens and bedded pack areas. Probably the most effective and inexpensive scraper combination is a small utility tractor with a box type scraper. (3) Alley scraper--a reversible motor driven endless chain or cable-propelled scraper blade along the free stall or feeding alley. The speed of these units is slow enough that animals readily step over the blade as it passes them. Alley scrapers save daily scraping time and allow more frequent scraping, thus resulting in cleaner alleys. (4) Large piston pumps--transfer pumps that are usually installed below the barn floor and include a hopper to receive manure. They are used in both stanchion and free stall barns. (5) Hollow piston pumps--large, hollow (valve in) piston manure pumps with rectangular shaped pistons ranging in size from 8 in. x 8 in. to 8 in. x 15 in. The piston is hollow. Manure must pass through the piston during the pumping cycle. These pumps are commonly used with free-flowing manure when liquid storage is planned. (6) Solid piston pumps--these usually have a round piston about 10 in. in diameter with a solid end. The pump is installed horizontally at the bottom of a concrete pit with the receiving hopper above it. The fact that the manure does not have to go through a piston or around connecting rods makes this pump well suited for use with manure that contains a lot of bedding or long straw and hay. (Merryman-East Central)

4322-A1, B2, B5, C2, E2, F1
THERE'S MONEY IN MANURE IF HANDLED RIGHT

R. H. Robson
Canadian Dairy Farmer, p. 4-7, March, 1974. 4 fig., 2 tab.

Keywords: Dairy wastes, Fertilizers, Land disposal, Liquid wastes, Crop response, Corn, Wheat, Management, Slatted floors, Pollution, Economics, Nutrients.

Basically, the dairyman has a choice of 3 systems of waste management: (a) liquid storage, (b) dairy spreading of solid of semi-solid manure and (c) winter storage, plus daily spreading during the summer months. Emphasis on pollution control and the public's sensitivity to farm smells caused Stan Kogut of Hagersville, Ontario to weigh carefully the selection of a manure handling system. Stan incorporated many of his own ideas into the construction of his 150-cow free stall dairy barn. Part of the construction included a liquid manure handling system based on the slatted floor principal. The system holds 8 months manure. Stan is now making money from manure, and because he followed closely the Agricultural Code of Practice, he can relax in the knowledge that his cows do not in any way contribute to a pollution problem. From an economic point of view, the main consideration in choosing a waste management system is: Does the manure have sufficient nutrient value to pay for its use as a fertilizer and pay for its handling costs. As in all farm situations, the method of manure handling is going to have to fit the needs of the dairyman under his conditions and management. Stan utilizes his dairy wastes in the fall by spreading it on his winter crop and in the spring by spreading it on his corn land. Stan figures that, based on available research figures, the value of his dairy manure is about $5,000 annually. This minus annual handling costs of $3,864.00 gives a margin on the plus side of just over $1,000. (Merryman - East Central)

4323-A6, A7, B1, C2, D1, D3, E2, F2
CONTROL OF GASES AND ODORS FROM LIVESTOCK UNITS

Department of Agricultural Engineering, Ohio Agriculture Research and Development Center and Ohio State University, Columbus, Ohio 43210
R. K. White
Proceedings, Soil Conservation Society of America, p. 34-37, 1973. 3 fig., 1 tab., 16 ref.

Keywords: Air pollution, Gases, Odor, Legal

aspects, Management, Confinement pens, Aeration, Ventilation, Land spreading.

An increase in the number of confined livestock operations has been accompanied by an increase in air pollution problems -- gases and odors. Law suits have been brought successfully against livestock producers because of odor nuisances. This accentuates the need for odor control. The odor pollution potential of a livestock production operation is affected by the number and kind of animal, the type of housing or lack of housing, the manure handling system, the manure disposal system, and the weather. Environmental parameters that affect gas and odor production are temperature, pH, moisture conte..., and oxygen concentration. Increase in temperature, dilution of wastes, and increase in fatty acids generates more odor. Aeration virtually eliminates odor production. The principle gases generated in manure handling are hydrogen sulfide, ammonia, carbon dioxide, and methane. Gases and odors that occur in confinement buildings, in exhausted air from such buildings, and in field spreading of manure should be controlled. Odor within confinement buildings may be controlled by daily removal of manure. If the manure is stored in pits beneath slatted floors or cages, odors and gases can be controlled by exhausting the ventilation air from beneath the slats and cages. When odorous air is exhausted from livestock buildings through openings on the side of the building, near the ground level, little dispersion of the odors occurs unless there is a "brisk" wind. To overcome this, some producers have exhausted the gases and odorous air through stacks above the building, where air currents can disperse them. Since aeration controls odor, aerobic techniques such as the oxidation ditch, aerobic lagoon, or composting may be employed. When wastes are being land spread, it is best to spread in the morning and when there is a slight breeze to disperse the odors. (Merryman-East Central)

4324-A1, B2, C1, C2, D3, E2
DESIGN PROCEDURES FOR ANIMAL WASTE TREATMENT LAGOONS

Department of Agricultural Engineering, Institute of Food & Agricultural Sciences, University of Florida, Gainesville, Florida
L. B. Baldwin and R. A. Nordstedt
Paper No SE71-214, American Society of Agricultural Engineers, Southeast Regional Meeting, Jacksonville, Florida, 1971, 23 p. 5 fig., 4 tab., 5 ref.

Keywords: Dairy wastes, Design, Lagoons, Land application, Florida, Chemical properties, Physical properties.

On large dairies in Florida, the need to contain wastes required the development of some design guidelines prior to accumulating data from research projects with various systems. Criteria for lagoon designs are now in use which are acceptable to the regulatory agencies, subject to change as shown by research. The criteria rely heavily on engineering judgement and experience for the design of systems which pose a minimum pollution and which are economically feasible. Recommendations are based upon the return of wastes to the soil-plant system. In treating the wastes, the protection of ground water, avoiding high odor emission, and maintaining a viable soil-plant system for nutrient uptake was needed. Careful analysis is needed in the design of animal waste management. The means of final dispersal to the soil is the most significant component of the waste handling system. To offset the lack of regular, periodic attention and maintenance, some degree of automation is generally necessary. Unbalanced or continuous application of waste to a portion of the receiving soil-plant system is to be avoided. (Rowe-East Central)

4325-A11, B2, B3, B5, C2, D2, E2, E3
THE POTENTIAL TOXICITY OF COPPER-RICH ANIMAL EXCRETA TO SHEEP

Moredun Research Institute, Edinburgh EH17 7JH, Scotland
N. F. Suttle and J. Price
Animal Production, V. 23, Pt. 2, p. 233-241, 1976. 2 fig., 1 tab., 19 ref.

Keywords: Refeeding, Copper toxicity, Sheep, Land application, Crop response, Slurries, Dried poultry wastes.

1. The true availability of Cu in animal excreta and pasture dressed with excreta was assessed in three experiments from the responses in plasma Cu concentration of initially hypocupraemic ewes repleted with diets containing different Cu sources. 2. Herbage from a sward treated with Cu-rich pig slurry contained a larger proportion of available Cu than untreated herbage (0.058 vs. 0.047; $P \leq 0.05$, Experiment 1). Herbage Cu content was also increased from 7.3 to a maximum of 10.2 mg Cu/kg DM by slurry application. 3. Availability of Cu in dried pig slurry (DPS) and Cu sulphate was similar and lowered from 0.068 to 0.040 in both sources by increasing the sulphur content of the diet from 1 g/kg in Experiment 3 to 3 g/kg in Experiment 2. Availability of Cu in dried poultry waste (DPW) was greater than that in DPS (P 0.05). 4. Treatment with ethylene diamine tetracetic acid extracted 64.3 percent and 78.3 percent of the Cu in DPW and DPS, respectively. 5. The Cu toxicity hazard associated with the recycling of animal excreta of high Cu content is discussed. (Copyright 1976-Animal Production)

4326-A10,B1
HYMENOPTEROUS PARASITOIDS ASSOCIATED WITH POULTRY MANURE

Department of Entomology and Economic Zoology, Clemson University, Clemson, South Carolina 29631
J. R. Ables and M. Shepard
Environmental Entomology, V. 3, No. 5, p. 884-886, Oct. 15, 1974. 1 fig., 11 ref.

Keywords: Fly control, Parasitoids, Poultry wastes, South Carolina.

Resistance to insecticides by the house fly (Musca domestica L.) and concern for chemical residues in the environment have resulted in increased emphasis on biological control of synanthropic flies. Entomologists in California began a search for indigenous and exotic parasitoids of flies in the early 1960's; Legner and Poorbaugh (1972) reviewed the current developments in biological control of flies and the results of parasite importation and release. Studies of biological control were mainly confined to subtropical regions (i.e., southern California and Florida). However, Mourier (1971) monitored seasonal occurrence of house fly parasitoids in Denmark. Little is known of the parasitoid fauna associated with poultry manure in the southeastern United States although Combe and Hoelscher (1969) reported several parasitoids attacking the horn fly, *Haematobia irritans* (L.), in Mississippi. We report here the occurrence and relative abundance of indigenous hymenopterous parasitoids of house flies and other parasitoids found on 2 poultry farms in western South Carolina. (Copyright 1974-Environmental Entomology)

4327-B3, C1, C2, D2, D3, E3
PRODUCTION OF AMMONIA SYNTHESIS GAS FROM MANURE IN A CYCLONIC BURNER

Department of Chemical Engineering, Texas Tech University, Lubbock, Texas 79409
I. J. Natour, H. W. Parker, and J. E. Halligan
Paper presented at 79th National Meeting of the American Institute of Chemical Engineers, Houston, Texas, March 16-20, 1975, 22 p. 7 fig., 2 tab., 10 ref.

Keywords: Recycling, Cattle manure, Ammonia, Hydrogen, Cyclonic burner, Waste treatment, Temperature, Physical properties, Chemical properties, Char.

A small scale air-fired cyclonic burner was constructed and operated to partially oxidize pulverized cattle manure without external heat or added fuel. The effect of increased reaction temperature, which was studied from 1110°F to 1480°F, showed that if sufficient heat transfer between entering and exiting streams is achieved, and the product gas shifted and reformed, the projected ultimate hydrogen yield will range from 7.2 to 13.8 standard cubic feet per pound of ash-free dry manure. (Natour-Texas Tech University)

4328-B2, B4, B5, C2, E2
DAIRY WASTE--FIELD APPLICATION STILL BEST

Anonymous
Confinement, V. 2, No. 6, p. 19, June, 1977.

Keywords: Dairy wastes, Storage systems, Liquid wastes, Land application, Nitrogen, Phosphate, Potash, Agitation, Ventilation.

Vernon Meyer of Iowa State University feels that the best manure handling system for most dairymen is hauling manure to the field and incorporating it into the soil. Storage options for such wastes include pits into which manure is loaded by a tractor and blade or a mechanical scraper, pits under slotted floors, above-ground circular liquid storage, and earthen storage. The manure from 40 milk cows yields approximately 5920 lb. of nitrogen a year, 2800 lb. of phosphate, and 5560 lb. of potash. This is the amount incorporated into the soil if the manure is stored in a liquid pit and injected when field spread. These same 40 cows would produce about 235,000 gal. of manure a year. To avoid a phosphate buildup in the soil, the manure should be spread at about 4 1500-gal. loads per acre if the same land is used each year. When pumping liquid manure from a pit, the manure should be agitated so that uniform distribution of the nutrients would be provided to the soil. Because agitation can release toxic gases, the area should be adequately ventilated. (Merryman-East Central)

4329-A11, B1, C1, C2, E3

USE OF DRIED PAUNCH RESIDUE IN RUMINANT DIETS

Anonymous
Canadian Journal of Animal Science, V. 55, No. 3, p. 471-472, Sept., 1975.

Keywords: Paunch manure, Refeeding, Sheep, Cattle, Digestibility, Performance, Chemical properties, Physical Properties.

A study was conducted to assess the digestibility of dried paunch residue (DPR) by sheep and its acceptance as a major component of the diet of beef cattle. The digestibility trial was conducted using 4 sheep with DPR as their entire diet. The DPR contained 94.6 percent dry matter, 14 percent protein, 31.7 percent acid detergent fiber, 1.13 percent calcium, 0.79 percent phosphorus, 8.4 percent ash, and 12.3 percent ether extract. The sheep were fed the DPR for 3 weeks and total collections of feces were made for the final 7 days. In the DPR, 52.7 percent ± 2.54 of the dry matter and 66.2 percent ± 4.53 of the protein were digestible. When testing the acceptability of DPR as a maior component of the diet of steers, 24 steers were divided into 3 uniform groups and fed diets of 70:30, 80:20, or 90:10 DPR and alfalfa cubes. Total feed intake was greatest by steers fed the 70 percent DPR diet. However, DPR intake was similar by steers fed 70 or 80 percent DPP. diets. Steers fed 70 percent DPR consumed more alfalfa cubes than those fed the 80 percent DPR diet. There were marked differences in weight gains of the steers. The gains of 0.57 and 0.42 kg/head per day by steers fed the 70 and 80 percent diets were similar ($P > 0.05$) and greater than the loss of -0.10 kg/day by steers fed the 90 percent diet ($P < 0.05$). The digestible energy of DPR was found to be 2,670 kcal/kg in the digestibility trial. The results demonstrated that paunch residue when cooked and dried can be fed to cattle. (Merryman-East Central)

4330-A2, A4, A5, B1, D1, D3, E2

WASTE DISPOSAL IN BEEF FEEDLOTS

New Zealand Agricultural Engineering Institute, Lincoln College, Canterbury, New Zealand
D. J. Hills
New Zealand Journal of Agriculture, V. 128, No. 3, p. 33-35, March, 1974. 5 fig.

Keywords: Feedlots, Management, New Zealand, Agricultural runoff, Water pollution, Groundwater pollution, Windrows, Land spreading, Application rates, Location.

The author explains feedlot management practices in the United States that could be adapted in New Zealand. There are two waste disposal problems associated with feedlot waste disposal, removal and disposal of manure, and the possible water pollution of streams, lakes, and groundwater when rainfall runoff comes in contact with the manure. The manure should be rationed on the feedlot surface so that biological decomposition and drying process will reduce the quantity and improve its characteristics. Then the waste should be removed from the feedlot surface mechanically once or twice a year and stockpiled or windrowed. The next step is to transport it to and spread it on farm land, not so much for its fertilizer value, but because land disposal is a low-cost method of disposal. One acre of crop land can safely use 10 tons of dry manure a year. The management of feedlot runoff depends on the hydrology and topography of the location of the feedlot. Care must be taken so that runoff from outside the feedlot will not flow into the feedlot. Rain falling into the feedlot should be collected in drain ditches, pass through a settling basin and be stored in a detention pond. This stored runoff should be spread on crop land before the next storm. The location of a feedlot farm should be about 3 miles from urban area, at least 1 mile from a housing development and 0.5 miles from the nearest residence. (Solid Waste Information Retrieval System)

4331-C1, C2, D2, E3, F3

AMMONIA SYNTHESIS GAS FROM MANURE

K. L. Herzog
M. S. Thesis, Texas Tech University, Dec., 1973, 50 p. 7 fig., 5 tab., 38 ref.

Keywords: Oxidation, Fluidized bed reactor, Recycling, Equipment, Design, Hydrogen, Gases, Char, Chemical Properties, Physical properties, Ammonia synthesis gas.

Continuous partial oxidations of manure were conducted in a bench-scale study using a small fluidized bed reactor to determine reaction products and yields and to investigate the feasibility of such a process. It was found that partial oxidation of cattle manure, if followed by desulfurization and reforming steps, can result in a gas suitable for the synthesis of ammonia. In raising the temperature of the partial oxidation reaction, increased yields of gases which are sources of hydrogen may be obtained. The upper limit to this gas production was not seen, but the ammonia equivalent of manure was shown to be in excess of 0.5 ton NH_3 per ton of dry, ash-free animal waste. Tentative energy balances indicate that the partial oxidation step of a synthesis gas from manure process would require the addition of little or no chemical and latent energy. However, sensible energy conservation would be required to make the step adiabatic unless the energy in the char were to be recovered. (Merryman-East Central)

4332-B5, C2, E2, F3

USING ORGANIC WASTES AS NITROGEN FERTILIZERS

Department of Soil Science, University of California, Riverside, California
P. F. Pratt, F. E. Broadbent, and J. P. Martin
California Agriculture, p. 10-13, June, 1973. 2 fig., 3 tab.

Keywords: Organic wastes, Land application, Application rates, Decay series, Mineralization, Nitrogen, Crop response, Constant input approach, Constant output approach.

This study proposes an approach for long-term utilization of organics as nitrogen sources. The rate of mineralization is the key to the rate of application of any given material. The yearly rates of mineralization are expressed as a series of fractional mineralizations of any given application, or the residual of that application. These are referred to as a decay series. A "constant input" approach may be taken in applying organic materials. This means that calculations are made for the expected yearly nitrogen mineralized for given combinations of decay series and constant rates of annual application of organic material. Because there is a gradual increase in yearly mineralization as the residual organic nitrogen in the soil increases, constant rates of application of most organic nitrogen sources are not desirable. If a constant rate that will build up to the desired yearly mineralization is being used, it can be supplemented with inorganic sources until the organic source can supply all that is needed. The "constant output" approach is another alternative. The objective of this approach is to determine the amounts of any given materials required per year to maintain given yearly rates of mineralization. If inorganic sources of nitrogen were to be completely replaced by organic sources for a given cropping system, this constant output approach would be much more desirable than the constant input approach. However, the limitations of the constant output approach might be the soluble salts that are added with the high rates of organics required during the first few years. In some moderately saline soils, the increment of salt added with the manure might be sufficient to reduce yields during the first few years. (Merryman-East Central)

4333-A6, A11, A12, B1, C3, E3, F1

USE OF AGRICULTURE WASTES IN AQUACULTURE

Louisiana State University, Baton Rouge, Louisiana
S. P. Meyers
Feedstuffs, V. 49. No. 11, p. 34, 50, March 14, 1977. 1 tab.

Keywords: Aquaculture, Fish, Feeds, Organic wastes, Performance, Costs, Sewage, Odor, Pathogens.

During the past three years at the Fish and Aquaculture Research Station, Dor, Israel, organic wastes (fluid cow manure containing urine and feces) have been used in fish ponds to replace part or all supplemental feeding. These experiments were developed both under controlled conditions in 400 sq. meter ponds as well as normal operating conditions in commercial fish ponds ranging in size from 0.5 to 10 hectares. The addition of such organic wastes to fish ponds resulted in a significant increase in natural productivity. Use of organic wastes brought large increases in fish yield per unit area of pond along with notable decreases in the feed conversion coefficient. Stocking a range of fish that occupy different ecological niches in the pond improved both the use and efficiency of food conversion and utilization of uneaten food and fish droppings. Feeding organic wastes was calculated to cost about 10 percent of the price of conventional feeding. Basic microbial decomposition, especially in terms of such things as dissolved oxygen depletion which can cause fish kills, must be studied and monitored. In related studies, the utilization of human sewage in fish ponds for fish production was followed by a "flush out" period in which fish were removed and put into fresh water ponds so that any residual objectionable odors and pathogens could be removed. The entire fish culture/sewage treatment system was observed to be a symbiotic relationship, with the fish improving the treatment of sewage waste and the sewage increasing yield of fish. It is thus observed that disposal of organic wastes may be changed from a potential for pollution into a source of valuable and profitable proteins. (Merryman-East Central)

4334-B1, D1, D2, D3, E2, E3, F1
UTILIZATION OF LIVESTOCK WASTES: ALTERNATIVE TREATMENTS AND PRODUCTS

Department of Agricultural Engineering, University of Illinois, Urbana, Illinois 61801
H. C. Kim and D. L. Day
Illinois Research, V. 19, No. 1, p. 10-11, Spring, 1977. 1 fig.

Keywords: Recycling, Physical treatment, Chemical treatment, Biological treatment, Land spreading,Fertilizers, Refeeding, Hydroponics, Composting, Aerobic digestion, Anaerobic digestion, Ensiling, Dehydration, Fractionation, Hydrogenation, Pyrolysis, Extraction, Chemical preservation, Enzymatic hydolysis, Energy, Economics.

Many products can be obtained from livestock wastes. Each product probably determines, or is determined by, the type of facility, the method of collecting and handling wastes, the kind of animal, and the desired method of utilization. Animal wastes may be treated biologically, chemically, or physically. Biological alternatives include: land spreading as a fertilizer and soil builder, hydroponic culture, composting, aerobic digestion (as in oxidation ditches), anaerobic digestion, and ensiling. Resulting products, depending on type of treatment, may be used as soil fertilizers and/or conditioners or for refeeding. Physical treatments that have been employed are dehydration and fractionation. Products from these processes have been used for refeeding. The residue fraction from fractionation can be pressed into fiberboard-like products. Two chemical treatments that have been used in converting bovine waste to oil and gas energy are hydrogenation and pyrolysis. Another chemical method, extraction, has been studied as a means of recovering a protein-rich food supplement from livestock wastes. Chemical preservation has also been used to recycle animal manure as a food supplement. The chemical process of enzymatic hydrolysis has resulted in up to 230 milligrams of glucose equivalents of reducing sugar per gram of manure. Four common treatments were analyzed in terms of energy and monetary budgets, assuming hypothetical facilities that market 4,000 hogs a year. The use of manure for fertilizer was found least expensive. This was followed by anaerobic digestion for methane gas, oxidation ditch for the production of single cell protein, and dehydration for feed supplement. (Merryman-East Central)

4335-A11, B3, D3, E3
UTILIZATION OF SUNFLOWER SILAGE, SUNFLOWER HULLS WITH POULTRY LITTER AND SUNFLOWER HULLS MIXED WITH CORN SILAGE FOR GROWING DAIRY ANIMALS

University of Minnesota, Crookston, Minnesota
G. D. Marx
Presented at the 72nd Annual Meeting of the American Dairy Science Association, Iowa State University, Ames, June 26-29, 1977, 6 p. 8 tab.

Keywords: Silage, Sunflowers, Poultry litter, Ensiling, Holstein cattle, Performance.

Three University of Minnesota experiments were conducted to compare the value of sunflowers and by-products of sunflower processing for cattle feed. All feedstuffs were individually sampled each week and composted each month for analyses. Animals were weighed monthly. In trial I, 38 Holstein steers were divided into 2 equal lots with one lot receiving whole plant sunflower silage and the other receiving alfalfa haylage. Each lot was fed 8 lb. of ground barley per head plus all the silage they would consume. Animals fed the sunflower silage gained .97 kg daily and those on the alfalfa haylage gained 1.05 kg/day. Total dry matter feed intake was similar in both groups. In trial II, 34 Holstein steers were divided into 2 equal lots with one receiving unlimited amounts of ensiled poultry litter and sunflower hulls and the other receiving unlimited amounts of alfalfa haylage. Both lots received 10 lb. of barley/head/day. Trace mineral salt and dicalcium phosphate minerals were supplemented. Body weight gains were significantly less ($P < .05$) in the group fed the sunflower hull-poultry litter mixture. Total dry matter intake was only slightly less for the sunflower hull-poultry litter silage group. In trial III, a steer and heifer group on a mixture of half sunflower hulls and half corn silage on an as fed basis was compared with control groups receiving all corn silage as the forage portion ofthe ration. In addition, all steers on both forage rations received 10 lb. of barley per head daily. Heifers fed the sunflower hulls-corn silage mixture received 3 lb barley pe head daily. Heifers fed the sunflower hulls-corn silage mixture received 3 lb barley per head supplemented with urea at 2.5 kg/MT 5 lb/ton). No barley was fed to the heifers on the all corn silage ration. Trace minerals, salt, and dicalcium phosphate, and vitamins A and D were supplemented to all groups. Three of the heifers developed impacted abomasums. All heifers were removed from the experiments on Nov. 23 with no additional subsequent problems resulting from the previous ration on the remaining yearling heifers. Steers remained on the trial for 90 days with no ill effects. Animals fed the sunflower hull-corn silage and barley mixture consumed less feed and gained significantly less ($P < .05$) than the group fed corn silage and barley. (Albertson-East Central)

4336-B2, D3, E3
BUILDING A BIO-GAS PLANT

R. B. Singh
Compost Science, p. 12-16, March-April, 1972. 1 fig., 1 tab.

Keywords: Bio-gas plants, Design, Liquid wastes, Agitation, Heating, Circulating, Digestion, Gases.

Five bio-gas plants are presented which exemplify the range of plants available. They draw on construction techniques used on gas plants in many areas of the world. All of the systems have been successfully operated. They all share in common some means of heating, or at least effective circulation of the slurry, and basic simplicity of operation. Some are more sophisticated in design and will require somewhat more care in construction and operation while others are simple and will give excellent results with a minimum of attention. The five digestors are: (1) Single stage, double chamber small bio-gas plant - an underground tank that produces about 100 cft gas/day from 5 cows. (2) Two-stage digestor - a two-chamber underground digestor for use with 50 or more cows. (3) Large single stage plant - a very large underground bio-gas plant that provides the thoroughness of the two-stage plant in the compactness of a single digestor. (4) Single stage multiple digestor plant - an above ground tank requiring heating. (5) Vegetable digesting gas plant - a small plant which is simple in construction. Size is determined by amount of vegetable accumulated in 2 months. Design and operating criteria are given for all these plants. (Bates-East Central)

4337-B1, C1, C2
FEED INTAKE AND MANURE SOLIDS FROM LACTATING HOLSTEIN COWS

Washington State University, Pullman, Washington 99163
M. H. Ehlers, D. F. Bezdicek, R. E. Hermanson, and R. W. Wallenius
Paper presented at 72nd Annual Meeting, American Dairy Science Association, Iowa State University, Ames, June 26-29, 1977, 4 p. 2 tab.

Keywords: Dairy cattle, Feed intake, Manure solids, Total solids, Nitrogen, Milk, Manure.

Research was done to relate dry matter or total solids supplied in feed and in bedding and nitrogen in feed with total solids and nitrogen in milk and with total solids and nitrogen in collectable manure for a Holstein herd having high milk yield. Young Holstein cows in all stages of lactation (except dry) were group fed roughage and individually fed concentrate. The cows were housed in free stalls and fed at fence-row feeders and at lot bunkers. Milking parlor wastes drained to a collecting tank. The tank liquid was circulated daily by pump through a sump into which free stall and lot manure was tractor scraped. Exterior lot rain also drained manure to the collecting tank. Tank contents were emptied daily into a lagoon. Manure values were determined by weekly sampling of 24 hr. tank contents. Observed bedding usage and estimated feed loss accounted for 22 percent of the total solids in collectable manure (composed of milking parlor waste, tractor scrapings, and rain drainage). Excreta solids exceeded estimated amounts. Study results are tabulated. (Merryman-East Central)

4338-A4, A11, B3, C2, C3, D1, E3
DRIED CATTLE PAUNCH MANURE AS A FEED SUPPLEMENT FOR CHANNEL CATFISH

Environmental Protection Agency, Robert S. Kerr Water Research Center, Ada, Oklahoma 74820
S. C. Yin, R. C. Summerfelt, and A. K. Andrews
Proceedings, Oklahoma Industrial Wastes and Advanced Water Conference, V. 23, p. 75-82, 1972. 1 fig., 1 tab., 9 ref.

Keywords: Refeeding, Dried paunch manure, Catfish, Drying, Storing, Bacteria.

This report describes some of the preliminary work done with paunch manure prior to launching a full-scale experiment to test the feasibility of using dried paunch as a feed supplement in channel catfish culture. Data concerning actual time requirements for successful drying were inclusive, but the paunch was air dried successfully and it was found that the dehydrated product could be stored for months without spoilage. While dried paunch incorporated into fish feed conceivably could become a serious water pollutant, if the amount of feed given each day is based on a certain percentage (usually 2-3 percent) of the body weight of the fish such pollution is not likely. The feed should be consumed by the fish within a short period of time. However, in a suspended cage culture situation, the pellets may eventually drift out of the confines of the cage where the fish cannot reach them. If that should happen, the dried paunch in the feed would definitely pollute the water, depleting the dissolved oxygen to the detriment of the fish. Studies will be done to provide an answer to this problem. No *Salmonellae* were isolated from the fresh paunch and it was decided that this was probably due to the paunch's low pH. Because of the low pH, the material may be safe from contamination by pathogenic bacteria; however, this must be verified. Catfish studies to be conducted at Oklahoma State University are expected to produce reliable and conclusive information on whether dried paunch is suitable as a feed supplement in channel catfish culture. (Rowe - East Central)

4339-A5, A8, C2, C3, E2
WASTEWATER RESEARCH EXPANDS

C. Woods
Sunshine State Agricultural Research Report, V. 17, No. 5-6, p. 3, 4, Nov.-Dec., 1972. 3 fig.

Keywords: Municipal wastes, Sewage, Land disposal, Forages, Crop response, Sprinkler irrigation, Groundwater quality, Sampling, Chemical properties, Biological properties.

A $98,100 grant from the U. S. Environmental Protection Agency has been awarded to the Institute of Food and Agricultural Sciences to test a new method of recycling municipal sewage water through farmland. A major goal of the research is to demonstrate the feasibility of discharging about 2½ million gallons of effluent from the Tallahassee Southwest Wastewater Treatment Plant over farmland through a sprinkler-irrigation system. The research is also attempting to determine the response of forage crops (oats, rye, Ryegrass, sorghum, kenaf, corn millet and coastal bermudagrass) to various application rates and frequencies—ranging from 1 to 8 inches/week. Plant and soil samples will be collected from each test plot for analysis. Plant responses to nutrients in wastewater, efficiency of removal, and forage quality for animal feed will be checked. Wells will be installed to monitor changes in the chemical and bacteriological levels of groundwater. Emphasis will be placed on developing operational guidelines from this type of sewage disposal system. Other IFAS research is being done on a similar wastewater system in cooperation with Disney World and a sprinkler irrigation system for animal wastes is being tested at the University's Dairy Research Unit. (Bates-East Central)

4340-A1, B1, E2, F4
CAST REVIEWS USDA WASTE MANUAL

Anonymous
Confinement, V. 2, No. 6, p. 17, June, 1977.

Keywords: Manuals, Land application, Guidelines, Environmental effects, Waste management.

A 208-page manual for evaluating the agronomic and environmental effects of applying animal waste to crop and pastureland and for developing management guidelines was prepared by 7 scientists representing the U.S. Department of Agriculture. It was reviewed by the Council for Agricultural Science and Technology (CAST). The CAST reviewers consisted of 14 scientsts with collective expertise in agricultural economics, agricultural engineering, agronomy, animal science, chemical engineering, meteorology, sanitary engineering, and soil science. The CAST Task Force felt that the authors of the manual had done a commendable job. However, the reviewers did suggest that the exact information that was presented, apparently to facilitate utilization of the worksheets, could divert attention from basic principles which are so important to tailor information for local conditions. More attention should have been directed to the effect animal production units may have on presented values. Inclusion of value ranges appropriate for different pretreatment, management of conservation techniques would be desirable to provide an indication of the potential range of answers. The CAST reviewers stated, "To exclude any of the excellent information in the manual would seem inappropriate. Continual emphasis on proper use of the data is needed, however, to ensure that the excellent work in the document is not misused and does not become counter-productive." Once the manual is revised, it will be released jointly by the U.S. Department of Agriculture and the Environmental Protection Agency. (Rowe-East Central)

4341-B1, E2
LONG TERM MANURE STORAGE

H. L. Brodie
Cow Moos, p. 15, May-June, 1977.

Keywords: Waste storage, Fertilizers, Land spreading, Time, Labor.

Maryland farmers are cautioned to reconsider long term manure storage unless they are prepared to invest considerable time and money. Consider that for 100 cows 12 months storage of manure would require a storage volume of 91,250 cubic feet (assuming waste production of two cu. ft./cow/day plus one-half cu. ft./cow/day of water to allow handling manure as a liquid) or two 62 ft. diameter covered tanks with 16 ft. of storage depth. The farmer would then want to plow the manure under just before planting in order to make the best use of the fertilizers. This would take a 2000-gal. capacity manure spreader 342 spreader loads (91,250 cu. ft. = 684,375 gals). Assuming each load would require 15 minutes with continuous operation using one tractor to agitate, one spreader and field tractor and one man, the spreading would take 86 hrs. (assuming no downtime). In order to make long term storage pay, the farmer has to be prepared to empty storage and spread manure at the very time of the year when he is hardest pressed to get crops planted. (Bates-East Central)

4342-B1, B4, B5, C2, E2
C+P+S+T+A = -N or WHY POOR WASTE MANAGEMENT COSTS YOU MONEY

University of Nebraska, Lincoln, Nebraska
G. L. Goranson and C. B. Gilbertson
Confinement, V. 2, No. 6, p. 11, June, 1977. 3 tab.

Keywords: Livestock wastes, Poultry wastes, Fertilizers, Land application, Nutrients, Economics, Waste handling, Waste storage.

The high cost of commercial fertilizer and serious environmental pollution problems make the use of manure as a resource a necessity. Nitrogen is the most important single fertilizer element in livestock and poultry wastes. Because some nitrogen is lost to the air by volatilization before the wastes are collected (by use of poor methods of waste processing, storage, transport, and application), 50 percent of the available nitrogen is lost. If nitrogen losses could be reduced by 20 percent, more than .6 million tons of N would be available for cropland application. The sooner wastes are collected and applied to cropland the better. Extended storage decreases manure's nitrogen content. When storage is necessary, dry storage is the best way. The moisture content of the wastes available is very important when related to land application. The more moisture in the residue, the greater the quantity that must be hauled to the field to provide adequate fertilizer. Before applying manure, allowances must be made for the type of crop grown and the amount of nitrogen already available in the soil. (Albertson-East Central)

4343-A9, A10, B1
AUTOMATIC FLY CONTROL

Anonymous
Confinement, V. 2, No. 5, p. 11, May, 1977. 1 fig.

Keywords: Fly control, Poultry farm, Accudose®, Aerosols, Pyrethrins.

Accudose®, a new fly-control system, was developed by Grady Query of Cesco, Inc., Charlotte, North Carolina. Accudose® is a permanently installed aerosol system that instantly smothers the area with an ultra-low dose of synergized pyrethrins. The aerosol is applied for less than 20 seconds once a day – between 2 a.m. and 3 a.m., when most of the flies have entered the house and bedded down for the night. Application is simultaneous throughout the system, so the flies cannot escape the insecticide. The system, which is comprised of copper tubing serving nozzles equipped with solenoid valves connected to a timer, is pressurized at all times. Bill Fenters of Clarendon Poultry Farm, Manning, South Carolina, used the system and virtually eliminated his fly problem from the first day on. (Rowe-East Central)

4344-B1. C2, D3, E3
ANIMAL WASTES AS SUBSTRATES FOR PROTEIN PRODUCTION

Biological Waste Management Laboratory, Agricultural Environmental Quality Institute, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland 20705
C. C. Calvert
Federation Proceedings, V. 33, No. 8, p. 1936-1939, Aug., 1974. 25 ref.

Keywords: Animal wastes, Substrates, Protein production, By-product recovery, Algae, Yeasts, Fungi, Microorganisms, House fly larvae, Earthworms, Recycling, Refeeding.

A review is given of various systems that utilize animal waste nitrogen in the production of protein suitable for either human food or livestock and poultry feed. The use of algae to convert manure to a usable feed-grade protein supplement has received much attention and appears to have the most promise. The drawbacks to this system are the amount of space required for such algal ponds, high capital outlays, and topographic limitations on pond function and location. It is probable that yeasts could also produce protein from manure. Limitations on the nutritional use of yeast proteins would be their high nucleic acid content, gastrointestinal upsets, unpalatability, and economics. The systems utilizing bacteria or mixed cultures of microorganisms all show some promise in converting waste nitrogen to protein, but there is little published information available to make a critical evaluation of the procedures being used. Fungi, which have been studied extensively for utilizing carbohydrate wastes from a number of vegetable canning processes to produce protein, have been a successful source for producing protein. It is felt that they would also be successful in utilizing animal wastes as a substrate. Common house fly larvae and earthworms have been shown to utilize poultry and dairy cattle manures, respectively, to produce a usable high protein feedstuff. A particular advantage of both procedures is that one-half of the moisture and nearly all the odor are removed, leaving a friable material suitable for use as potting soils or soil conditioners. Costs of these operations have not been determined. Protein yields per ton of manure are quite low. Dried house fly pupae and adult flies have been found to be a satisfactory substitute for soybean meal in the diet of growing chicks. The nutrient value of earthworms has not been determined. (Rowe-East Central)

4345-A6, B2, C1, C2, D3, F1

AN EVALUATION OF A FULL-SCALE IN-HOUSE OXIDATION DITCH FOR POULTRY WASTE

S. P. Nieswand
M. S. Thesis, Cornell University, Jan., 1974, 140 p. 29 fig., 22 tab., 43 ref.

Keywords: Poultry wastes, Waste treatment, Oxidation ditch, Odor, Costs, Design, Aeration, Ammonia, Total solids, Total volatile solids, Nitrogen, Chemical oxygen demand.

The operating performance of a full-scale oxidation ditch for poultry wastes from an egg production operation is evaluated. Odor production, pollutional characteristics, and cost of waste handling are considered. It was found that, while typical anaerobic odors were controlled, an ammonia odor persisted in the laying house. Removal of total solids, total volatile solids, total Kjeldahl nitrogen, and chemical oxygen demand in poultry manure was as high as 47, 64, 58, and 59 percent, respectively, using an oxidation ditch for treatment. Waste handling cost was approximated to be $.0149 per dozen eggs using oxidation ditches compared to $.0081 per dozen eggs without oxidation ditches. It was found that the system being studied was under-designed in terms of oxygenation capacity and volumetric loading. Longer detention times were found to increase treatment efficiency. The oxidation ditch was found to be a feasible alternative for treating poultry wastes. (Merryman-Eart Central)

4346-A10

TABULAR KEYS & BIOLOGICAL NOTES TO COMMON PARASITOIDS OF SYNANTHROPIC DIPTERA BREEDING IN ACCUMULATED ANIMAL WASTES

Department of Entomology, University of California, Riverside, California 92502
E. F. Legner, I. Moore, and G. S. Olton
Entomological News, V. 87, Nos. 3&4, p. 113-144, March & April, 1976. 20 fig., 108 ref.

Keywords: Animal wastes, Breeding, Medical entomology, Diptera, Hymenoptera, Synanthropic flies, Parasitoids.

A tabular key and short discussion of salient biological characteristics are given for 9 genera and 14 species of parasitic insects commonly found attacking larvae and pupae of synanthropic Diptera in accumulations of animal wastes. Special included are *Aleochara* sp., *Trichopria* sp., *Tachinaephagus zealandicus* Ashmead, *Phygadeuon* sp., *Stilpnus* spp., *Muscidifurax raptor* Girault & Sanders, *M. raptorellus* Kogan & Legner, *M.* sp., nr. *raptorellus*, *M. raptoroides* K. & L., *M. uniraptor* K. & L.. *M zaraptor* K. & L., *Pachycrepoideus vindemiae* Rondani, *Spalangia cameroni* Perkins, *S. endius* Walker, *S. longepetiolata* Boucek, *S. nitra* Latreille, *S. nigripes* Curtis, *S. nigroaenea* Curtis, and *Sphegigaster* sp. Electron photomicrographs clarify the shape of certain diagnostic characters. References to other less common parasitoids, *Alysia manducatro* (Panzer), Figites sp., are made; and pertinent literature references are given. (Copyright 1976 - Entomological News)

4347-A6, A7, B2, C2, D2, D3, E3, F1

LIVESTOCK ODOR CONTROL RESEARCH AT THE UNIVERSITY OF ILLINOIS

Agricultural Engineering Department, University of Illinois, Urbana, Illinois 61801
D. L. Day, and A. H. Jensen
Paper 74-II-103, Section I. Theme 1, VIIIth International Congress of Agricultural Engineering, Flevohof, Netherlands, Sept. 23-29, 1974, 6 p. 37 ref.

Keywords: Odor control, Research, Illinois, Swine wastes, Confinement pens, Gases, Waste treatment, Chlorine, Hydrated lime, Oxidation ditch, Flushing, Refeeding, Aerobic conditions, Anaerobic conditions, Enzymes, Ionization, Economics.

This paper reports research projects at the University of Illinois from 1963 to 1973 for identifying and controlling objectionable gases and odors emanating from swine confinement buildings. The research projects were the result of cooperative efforts among the Departments of Agricultural Engineering, Animal Science, Sanitary Engineering, and Food Science. The first phase of research was an exploratory attempt to analyze and identify the gases and odors in confinement swine buildings. At normal ventilation rates, the concentrations of carbon dioxide, hydrogen sulfide, and ammonia were found to be well below the threshold limit values for human industrial occupancy. Treating liquid manure with chlorine was found to be a successful odor control method, but it was very expensive. The use of hydrated lime to raise the pH controlled hydrogen sulfide but increased ammonia release. The problems of chemical treatment led to emphasis on biological treatment. Oxidation ditches were found to give successful odor control, but the power requirement of the mechanical aerators were found to be a disadvantage. A laboratory study was therefore conducted to determine whether odors could be kept to a minimum if aeration were reduced so that no residual dissolved oxygen was present. Satisfactory low odor was achieved by keeping the oxidation-reduction potential in the regne of -300 to -400 mv. and the pH in the range of 7.7 to 8.5. It was also found that the refeeding of the oxidation ditch mixed liquor gave promise of a low-odor, low-labor environmentally acceptable method of livestock waste management. Anaerobic digestion of swine wastes mixed with municipal digester sludge for controlling odor appeared to be promising. Odor control by spraying chemicals on the surface of liquid manure pits at regular intervals was unsuccessful. Spraying enzymatic materials on the surface of an anaerobic lagoon was likewise unsuccessful. Another study determined that wastewater could be pumped from near a floating surface aerator for reuse in flushing manure from livestock buildings. Preliminary results from an investigation using ionization of swine building atmospheres for odor control seem encouraging. (Merryman-East Central)

4348-B3, C1, C2, C3, D1

AVAILABLE AMINO ACID CONTENT AND MICROBIOLOGICAL CONDITION OF DRIED POULTRY MANURE

Microbiology Department, ADAS/MAFF, Shardlow Hall, Derby DE7, 2GN, England
A. Hacking, M. T. Dervish, and W. R. Rosser
British Poultry Science, V. 18, No. 4, p. 443-448, July, 1977. 3 tab., 14 ref.

Keywords: Poultry excreta, Drying, Chemical analysis, Nitrogen, Moisture content, Methionine, Tryptophan, Leucine, Waste storage, Salmonellae, Coliform bacteria.

1. Excreta from laying hens, collected at daily or weekly intervals, was dried in a commercial oil-fired drier. Samples were analysed at monthly intervals over an 18-month period. 2. Leaving the excreta for 1 week resulted in a decrease in nitrogen content from 59.5 g/kg to 54.1 g/kg ($P < 0.05$) and in the moisture content from 108.5 g/kg to 83.3 g/kg ($P < 0.05$). 3. The mean values of available methionine, tryptophan and leucine were little affected by storage and were 0.340, 0.555 and 1.041 g/16 g N, respectively. 4. Salmonellae were not detected in any sample, coliform bacteria were detected in nine (26 percent) and anaerobic spore formers in 26 samples (76 percent). (Copyright 1977 - British Poultry Science)

4349-B2, C2, D3

LAGOON PRETREATMENT: SWINE WASTE LOADING RATE AND RESPONSE TO LOADING RATE CHANGE-LABORATORY SCALE

Biological and Agricultural Engineering Department, North Carolina State University, Raleigh, North Carolina
M. R. Overcash, F. J. Humenik and E. S. Howell
Transactions of the ASAE, V. 20, No. 2, p. 348-352, March-April, 1977. 4 fig., 3 tab., 10 ref.

Keywords: Swine wastes, Lagoon, Loading rates, Chemical properties, Ortho-phosphorus concentration, Chemical oxygen demand, Total oxidizable carbon, Total Kjeldahl Nitrogen.

Lagoon loading as a design variable was tested in an inclusive range of rates from 0.038 - 1.35 kg COD/d/cu m. Laboratory units (14 1) were used with swine waste and demonstrated an increasing, nearly linear relationship of effluent concentration (COD, TOC, and TKN) with loading rate. Orthophosphorus concentration, elevated at high loading rates, was attributed to hindered settling. For a two-fold decrease in residence time, with constant organic loading, little change in effluent (supernatant) concentration was evidenced. An upward change in loading, similar to increasing animal liveweight, caused an increased supernatant concentration (COD, TOC, and TKN) in 70 - 100 days. A decreased loading resulted in rapid re-equilibration of TKN (40 days) but very slow reduction of COD and TOC levels due to transfer of the products of sludge degradation to the supernatant. (Copyright 1977 - Transactions of the ASAE)

4350-B3, C1, D1, F1

DRYING CAGED LAYER WASTE

Agricultural Engineering Department, University of Georgia, Athens, Georgia
J. M. Allison and G. R. Bishop
Transactions of the ASAE, V. 20, No. 2, p. 390-392, March-April, 1977. 3 fig., 3 tab., 6 ref.

Keywords: Model studies, Poultry wastes, Deep pits, Ventilation, Moisture content, Electrical underheat, Economics.

A model study of the management of poultry waste in deep-pits indicated that it is possible for well distributed forced ventilation to remove nearly as much moisture from caged layer waste as does forced ventilation in combination with electrical underheat. The energy required for the electrical underheat cannot be economically justified. (Copyright 1977 - Transactions of the ASAE)

4351-A9, A10, B1, C2, C3, D2

INHIBITION OF LARVAL HORN FLY DEVELOPMENT IN THE MANURE OF BOVINES FED DIMILIN® MINERAL BLOCKS

Georgia Coastal Plain Experiment Station, Tifton, Georgia 31794
R. W. Barker and R. L. Jones
Journal of Economic Entomology, V. 69, No. 4, p. 441-443, 1976. 1 fig., 1 tab., 4 ref.

Keywords: Feed additives, Fly control, Cattle manure, Mineral blocks, IGR Dimilin®

In field tests, the IGR Dimilin® [N-(4-chlorophenyl) - N' - (2,6-difluorobenzoyl) urea] inhibited development of larvae of *Haematobia irritans* (L.) in feces of bovines that consumed mineral blocks containing 0.1 and 0.05 percent of Dimilin. Herds given the 0.1 and 0.05 percent mineral blocks consumed 36.5 and 26.8 mg AI/animal/day, respectively. Residue analysis of manure indicated that horn fly larvae were sensitive to concentrations of 0.13-0.52 ppm of Dimilin in the manure. Also, horn fly bioassay data showed larval development was inhibited 75 and 83 percent in manure of bovines that consumed the 0.05 and 0.1 percent mineral blocks, respectively. (Copyright 1976 - Journal of Economic Entomology)

4352-B2, B4, B5, E2, F1

UNDERGROUND SILOS FOR LIQUID MANURE

Staff Editor, Dairy Herd Management
G. Ashfield
Dairy Herd Management, V. 10, No. 12, p. 10-12, Dec., 1973. 5 fig.

Keywords: Dairy wastes, Waste storage, Silos, Land application, Economics.

Heath Farms of Tony, Wisconsin, has developed a new concept in waste handling and storage which makes effective use of available construction material. Two silos are above-ground and used in storing feed for dairy animals. Five other silos are completely underground, are partially covered by the dairy free-stall and milking parlor facility, and serve as waste holding tanks. The 4 main silos can hold up to 100,000 gallons of manure each and will fill to capacity in 8 months. The fifth silo pit which is buried beside the milking parlor end catches all the milkhouse wastes, has a 50,000 gallon capacity and will fill up in about 6 months. A trap door outside the building allows access to each silo and facilitates agitation and removal of wastes. The manure is spread at six-month intervals, utilizing a 2,400 gallon capacity liquid manure tank. Each silo requires about 40 trips to the field to empty. Carol Heath, who is in charge of the dairy, took special pains to insure that the waste system was approved by sanitation officials for use at his dairy. A new maternity and calf housing is now under construction and it will have a sixth waste silo. When this is completed, the Heaths will have a capacity of nearly 500,000 gallons of manure. Compared with the cost of conventional concrete liquid manure pits, the Heaths have found this system to yield advantageous savings in labor and material. (Bates-East Central)

4353-A1, B2, B3, B5, C2, D3, E2

DISPOSING OF OUR WASTES -- SOIL CAN FILTER, CROPS RECYCLE NUTRIENTS

Anonymous
Sunshine State Agricultural Research Report, V. 17, No. 3-4, p. 8-9, 12, July/Aug., 1972. 1 fig.

Keywords: Florida, Animal wastes, Municipal wastes, Land application, Nutrients, Crops, Research, Application rates, Dairy wastewater, Sprinkler irrigation, Composting.

The growth of cities and of the livestock, dairy and poultry industries - especially the creation of large centralized operations - poses an environmental threat through the buildup of large amounts of municipal and animal wastes. IFAS scientists believe that one of the most promising solutions to the problem is some form of treatment whereby the residual nutrients can be reused to grow crops. IFAS researchers are studying application of both municipal effluent and wastewater from livestock operations on a variety of crops. Different soil and plant filtering processes are being tested at different locations. These tests will eventually determine levels of application for optimum utilization by crops coupled with the most efficient removal of nutrients. A system of multistage lagoons and seepage irrigation is being tested on a large dairy operation in Manatee County, and another system is under study in cooperation with the city of Tallahassee with effluent from a sewage treatment plant. Researchers are studying the disposal of dairy wastewater by sprinkler irrigation at the Dairy Research Unit near Gainsville. A major research project in reusing wastes is also underway with Walt Disney World. IFAS scientists have been working with a county which is using a sprinkler system to spread water from sanitary landfill pits. Other systems under study for handling refuse and garbage are biological breakdown and processing of wastes into various types of mulches and compost. A suggested use is the incorporation of large amounts of composted waste into phosphate mining areas. (Bates-East Central)

4354-A11, B1, C1

FEED FED, MILK PRODUCED, AND EXPECTED EXCRETA SOLIDS OF DAIRY COWS

Washington State University, Pullman, Washington
J. K. Hillers, M. H. Ehlers, and R. W. Wallenius
Paper presented at the 72nd Annual Meeting, American Dairy Science Association, Iowa State University, Ames, June 26-29, 1977. 3 p. 2 tab., 1 ref.

Keywords: Dairy cattle, Feed consumption, Milk production, Excreta solids.

The relationship between feed consumption and milk production levels was investigated to evaluate possible changes in recommendations for dairy waste production. Monthly milk production and feed data (grain, hay silage) for 205 Holstein DHIA herds from October 1, 1975 to April 30, 1976 were computed. Herds with less than 30 cows were excluded from analysis. The means and ranges of milk production and feed consumption data are tabulated. The milk production and feed consumption figures were on a herd total basis and thus included dry cows. The expected feed consumption for the average cow in these herds was found to be 20.6 kg/day. Assuming 90 percent dry matter and 40 percent of the daily feed intake is not digested, the average cow in these herds would be expected to produce 7.4 kg excreta solids per day, which compares with the expected 7.1 kg from a 680 kg cow. The average cow in these herds of mixed aged Holsteins would probably weigh less than 680 kg. The expected increase in solids excreta for each 1 kg increase in milk production would be .119 kg. With the range of milk production present in dairy herds, recommendations on solids excreta produced should be adjusted for herd production level. (Merryman-East Central)

4355-B3, C2, C3, D3

EVALUATION OF ENSILING SWINE FECAL WASTE WITH GROUND ORCHARD GRASS HAY, PRELIMINARY REPORT

J. Berger, J. P. Fontenot, and E. T. Kornegay
Preliminary Report, Virginia Polytechnic Institute and State University, 1976, p. 199-200. 1 tab.

Keywords: Fermentation, Ensiling, Swine feces, Hay, Bacteria, Coliforms, Fecal coliforms, Lactic acid, pH.

A preliminary study was done to determine fermentation (ensiling) characteristics of different proportions of swine feces when ensiled with ground orchard grass hay. Swine feces were collected from finishing hogs housed on slotted floors. Feces were scraped from the waste pit and transferred to a 55 gal. drum. The feces were mixed in a horizontal mixer. They were then strained through expanded metal to remove any large fecal balls which might interfere with fermentation. Feces were mixed with ground orchard grass hay in the following respective proportions: 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80. Silos, made from one gallon food containers lined with 2 plastic bags, were packed with the feces-hay mixtures and were sealed and allowed to ferment for at least 45 days. There was a reduction in total bacteria and total coliforms and a complete destruction of fecal coliforms after ensiling for all proportions of feces and hay. Lactic acid concentrations and pH values indicated that ensiling took place and that a 50:50 mixture of feces and ground hay produced the best fermentation. (Merryman-East Central)

4356-A9, A11, C2, D2

ENCAPSULATED RABON FOR LARVAL HOUSE FLY CONTROL IN COW MANURE

Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland 20705
R. W. Miller and C. H. Gordon
Journal of Economic Entomology, V. 65, p. 455-458, 1972. 4 tab., 6 ref.

Keywords: Fly control, Feed additives, Insecticides, Cattle manure, Milk content, Milk production, Animal health.

A series of 5 trials was conducted to determine the feasibility of encapsulating Rabon (2-chloro-1-(2, 4, 5-trichlorophenyl) vinyl dimethyl phosphate) and feeding it to lactating dairy cows for control of *Musca domestica* L. larvae in the feces. In the 1st trial, an insecticidal balance experiment, 15 percent of the encapsulated Rabon reached the feces as compared with 0.3 percent that was found earlier with a 75 percent WP formulation. No (<0.005) Rabon appeared in the milk from this cow. The next 2 trials confirmed the feasibility of encapsulating Rabon for feed-additive use and they determined that the most effective formulation available was AC-360 which contained 59 percent active Rabon. When 30 ppm Rabon as AC-360 was fed to dairy cows, 100 percent of organophosphate-resistant house fly larvae seeded into the feces were killed. In a field trial, manure from cows fed 66 ppm Rabon (AC-360) or 66 ppm Rabon in a new (WT-80) encapsulated formulation caused a 94 percent reduction in fly larvae when compared with manure from control cows. In the final trial, 2 cows were fed 60 ppm Rabon as AC-360 for a 4- or 6-month period. The average concentration of Rabon in the feces of these cows was 2.24 ppm. Residues of Rabon in milk ranged between <0.005 and 0.013 ppm. No adverse effects on feed intake, milk production, or general health of these animals were observed. (Copyright 1972-Journal of Economic Entomology)

4357-A11, B1, E3

EXPERIMENTS IN RECYCLING SWINE MANURE IN FISHPONDS

Illinois Natural History Survey, Kinmundy, Illinois
D. H. Buck, R. J. Baur, and C. R. Rose
Presented at FAO Technical Conference on Aquaculture, Kyoto, Japan, May 26-June 2, 1976, 4 p. 5 tab., 8 ref.

Keywords: Swine manure, Fish feeding, Performance.

This is believed to have been the first attempt in North America to utilize certain Asian cultures and techniques in the solution of such problems as animal waste management, pollution control, and the production of protein. Two small Illinois ponds of similar size received nearly identical stockings of fish (three Chinese carps, common carp, largemouth bass, a hybrid buffalo fish and channel catfish), but different amounts of swine manure. One pond (0.127 ha) received the total wastes from five growing pigs (about 39 pigs/ha of water area), the other pond (0.121 ha) received the wastes from eight pigs (66 pigs/ha). Two consecutive lots of pigs were fattened during the experiment. Water levels were lowered at mid-season to improve natural circulation, but conditions were otherwise static, with no artificial circulation or aeration. Over a fish-growing period of about 170 days (May to October 1975) the net increments in fish biomass were at the rates of 2 971 kg/ha in the 0.127-ha pond, and 3 834 kg/ha in the 0.121-ha pond. The high production of fish was attributed to: (i) the high quality of the swine rations; (ii) an efficient density of stocking ratio of fish species; and (iii) effective water level management. A beneficial influence by the fish population on water quality was indicated by continuously adequate levels of dissolved oxygen, and final BODs in the range of 8-12 mg/1. (Buck-Illinois Natural History Survey)

4358-A3, A5, A8, B1, B5, C2, E2

CONSIDERATION OF SOILS FOR ACCEPTING WASTES

B. A. Stewart and L. R. Webber
Land Application of Waste Materials, Soil Conservation Society of America, 1976, p. 8-21. 5 fig., 10 tab., 79 ref.

Keywords: Land application, Soil properties, Soil environment, Microorganisms, Organic wastes, Animal wastes, Infiltration, Groundwater quality, Agricultural runoff, Nutrients, Nitrogen, Salts, Heavy metals, Land management.

The use of land application for waste management is increasing. Waste accumulations have greatly intensified in recent years, primarily because: (a) agricultural enterprises have tended to become concentrated, producing large amounts of waste in localized areas, and (b) increased population, rapidly expanding industrial development, and improved sewage treatment have led to greater amounts of sewage sludge and industrial wastes. Land is not a renewable resource; it is finite in area, depth, and in many characteristics that determine its productivity. To use land resources as an acceptor of and a medium to renovate or degrade wastes requires an appreciation for and a recognition of the demands that would be imposed on the soil. The qualities of a given soil (biological, chemical and physical) must be known to determine the capacity of soil to assimilate waste, subject to the constraints of nonimpairment or irreparable damage to soil productivity. The utilization of wastes on land involves a manipulation of a soil environment so that soil is not degraded, so that the food chain is not impaired, and so that water quality and supplies are not jeopardized. (Bates-East Central)

4359-A8, B1, C2, E2

CONSIDERATION OF SOILS FOR ACCEPTING PLANT NUTRIENTS AND POTENTIALLY TOXIC NON-ESSENTIAL ELEMENTS

Department of Soil Science, University of Wisconsin, Madison, Wisconsin 53706
L. M. Walsh, M. E. Sumner, and R. B. Corey
Land Application of Waste Materials, Soil Conservation Society of America, 1976, p. 22-47. 5 fig., 8 tab., 79 ref.

Keywords: Macronutrients, Micronutrients, Land disposal, Crop response, Crop selection, Soil selection, Animal wastes, Human wastes, Loading limits.

Soils can receive substantial quantities of most plant nutrients and nonessential toxic elements without developing phytotoxicity or accumulating elements in the food chain that may be harmful to man of animals. There are 16 chemical elements that are essential for most plants. Four other elements are essential for some plants. Concentrations of the essential elements in plants may be in the 0.1 to 5 + percent range for the so-called macronutrients--carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur and in the parts per million (ppm) range for such micronutrients as iron, manganese, copper, zinc, boron, molybdenum, nickel, cadmium, and chlorine. Development of sound fertilizer and waste disposal programs requires an understanding of nutrient assimilation and removal by plants, as well as the fate of those nutrients once they have been applied to the soil. In addition, the physical, chemical, and biological mechanisms of attenuation of all chemical elements must be considered whenever decisions are made on the land application of nutrients and nonessential, potentially toxic elements. This is particularly important when attempting to describe "loading limits", both short and long term, for elements that are of environmental concern. If farmers follow good soil management practices and apply nutrients at rates consistent with crop needs, water quality can be maintained. (Bates-East Central)

4360-A6, A7, A10, B1, B2, B4, B5, C2, E2, F2

LAND USE OF ANIMAL WASTES

Agricultural Research Service, U. S. Department of Agriculture, Pullman, Washington 99163
L. F. Elliott and N. P. Swanson
Land Application of Waste Materials, Soil Conservation Society of America, 1976, p. 80-90. 1 fig., 6 tab., 48 ref.

Keywords: Land application, Animal wastes, Nitrogen, Nutrients, Crop response, Odor, Aeration, Agricultural runoff, Vectors, Dust, Lagoons, Application rates, Site selection, Application methods, Waste storage, Aesthetics, Legal aspects.

With the increased cost of inorganic fertilizers, animal manures are again becoming a desirable fertilizer source. They are excellent crop fertilizers and soil conditioners. Usually, animal manures should be applied in amounts that meet the crop's nitrogen requirements. Exceeding this amount is wasteful and may result in pollution. Chemical analysis of manure and the soil it is to be used on is recommended. With proper management, nitrogen can be preserved in manures. Choice of proper application sites, amounts, and crops will result in no pollution problem and wholesome crops can be grown. There are no economical methods for odor control during manure removal from outdoor lots, except to keep the lots well-drained. Odors from manure handling will also be a problem for indoor feeding areas. Aeration is possible but expensive. When pumping out manure from a confined area, extreme caution must be used because of the possibility of hydrogen sulfide poisoning. When highly odorous manure is spread on the field, it must be incorporated immediately if the area is not isolated from neighbors. In establishing new feeding and utilization areas, professional consultation should be sought, zoning laws should be considered, and close proximity to towns and urban areas should be avoided. Runoff must be kept on the operator's property and dust insects and rodents must be controlled (Bates-East Central)

4361-A5, B2, C2

CHANGES IN SEEPAGE RATE FROM AN UNLINED CATTLE WASTE DIGESTION POND

Department of Water Science and Engineering, University of California, Davis, California
F. E. Robinson
Transactions of the ASAE, V. 16, No. 1, p. 95-96, Jan.-Feb., 1973. 2 fig., 7 ref.

Keywords: Cattle wastes, Waste digestion pond, Seepage, Conductivity, Nitrates, Groundwater pollution.

Solid and liquid wastes from 24 cattle were emptied into an unlined pit that was approximately 4 feet deep, 19 feet wide, and 77 feet long. The soil in the area of this pit was alluvial with layers of clay loam, silty clay loam, and clay to 5.5 feet, with a water saturated 6-inch layer of fine sandy loam at the 5.5 feet depth. The water table in the sand strata was sampled for conductivity and nitrate content prior to filling the pond. Sampling procedures were set up which allowed a comparison of conductivity and nitrate levels in the pond and the sand strata beneath the pond after the pond was put into use. The initial 4.4 in./day seepage rate dropped to 0.220 in. in 3 months and to 0.119 in./day in 6 months. Dilution of the groundwater around the pond was most rapid during the first 3 weeks, suggesting that the major seepage rate reduction took place during this period. Nitrate addition to the groundwater was about 0.427 lb/animal/year after 3 months and about 0.269 lb after 6 months. (Merryman-East Central)

4362-B2, C2, D3

EFFECT OF ARSANILIC ACID LEVEL IN SWINE DIETS AND WASTE LOADING RATE ON MODEL ANAEROBIC LAGOON PERFORMANCE

Animal Sciences Department, Purdue University, West Lafayette, Indiana
M. C. Brumm, A. L. Sutton, V. B. Mayrose, J. C. Nye, and H. W. Jones
Transactions of the ASAE, V. 20, No. 3, p. 498-501, May-June, 1977. 5 fig., 3 tab., 18 ref.

Keywords: Arsanilic acid, Swine wastes, Anaerobic lagoons, Performance, Diets, Model studies, Loading rates.

A 38-week randomized complete block design experiment was conducted to study the effects of three arsanilic acid levels in swine diets and 2 waste loading rates on the performance and nutrient composition of model anaerobic lagoons. Diets with 0, 90, or 180 g arsanilic acid per ton were fed to growing-finishing swine with total daily fresh waste collections. Model lagoons were loaded daily at the high rate of 0.102 kg volatile solids/m^3 (0.0064 lb/ft^3) or low rate of 0.051 kg volatile solids/m^3 (0.0032 lb/ft^3). All measured parameters (total N, aommonium-N, P, K, As, dry matter, volatile solids) increased in the lagoon with increasing time after initial startup, and the high rate increased concentrations of the lagoon parameters more rapidly than the low loading rate. It appeared that the lagoons had reached a steady state condition as evidenced by a gradual leveling of nutrients by the end of the experiment. Presence of arsanilic acid in the swine diets increased Kjeldahl nitrogen, ammonium nitrogen and elemental arsenic concentrations in lagoon effluent. However, there were no measurable adverse effects of dietary arsenic on lagoon performance. Results of this study showed that waste loading rate and time after initial startup have a greater effect on lagoon nutrient composition than does the amount of arsanilic acid in the swine diet. The lower loading rate was more nearly optimal for biodegradation of the waste. (Copyright 197-Transactions of the ASAE)

4363-A6, A11, B1, D2

ODOR INTENSITIES AT CATTLE FEEDLOTS

Texas Agricultural Extension Service, Texas A&M University, College Station, Texas.
J. M. Sweeten, D. L. Reddell, L. Schake, and B. Garner
Transactions of the ASAE, V. 20, No. 3, p. 502-508, May-June, 1977. 4 fig., 7 tab., 30 ref.

Keywords: Odor, feedlots, Cattle, Dilutions to threshold, Odor control, Feed additives, Calcium bentonite, Performance.

Odor intensities measured at two cattle feedlots in Texas ranged from 1.5 to 170 dilutions to threshold (DT), which covers the measurement range of the Barnabey-Cheney Scentometer. The average odor reading at the surface of a 4000 head feedlot, determined by monitoring four randomly selected pens for 7 mo., was 31 DT. The runoff settling basin and retention pond averaged 68 and 46 DT. Half of the odor intensities were more than 23 DT, which exceeds the odor standards in several states. Odor intensities were diluted to 1.5 to 2 DT within 380 to 500 m (1250 to 1650 ft) downwind of the feedlot. At a 12,000 head feedlot, calcium bentonite was fed as a ration supplement at the following levels: 0.0, 0.8 and 2.0 percent. The 2 percent bentonite treatment resulted in a reduction in odors. Bentonite also improved average dialy gain of cattle during the first 21 days. (Copyright 1977-Transactions of the ASAE)

4364-B1, B5, C1, C2, E2

THE CHARACTERISTICS AND MANAGEMENT OF MINK WASTES

Animal Science Department, Cornell University, Ithaca, New York
J. H. Martin, Jr., T. E. Pilbeam, R. C. Loehr, and H. F. Travis
Transactions of the ASAE, V. 20, No. 3, p. 515-518, May-June, 1977. 3 tab., 9 ref.

Keywords: Mink wastes, Production rates, Chemical properties, Physical properties, Nitrogen, Land application.

Production rates and characteristics of mink wastes were determined over a 2-yr period. The data collected showed that mink wastes contain higher concentrations of nitrogen compared to the wastes of other domestic animals. To permit estimation of waste production under commercial conditions, the concept of a mink unit was developed. Based upon nitrogen content, it was estimated that 55 ha (136 acres) of land used for corn production is required to dispose of the waste production from 2,000 mink units. In formulating guidelines or regulations for the disposal of mink wastes, it should be recognized that extrapolation of application rates in terms of kg/ha of wet manure or dry solids which are based upon experiences with other animal wastes can be inappropriate. The significantly higher concentration of nitrogen in mink wastes could lead to excessive nitrogen application to the soil. Therefore, application rates should be based on the nitrogen content of the treated or untreated wastes. Ideally, mink wastes should be disposed of on only productive land where crop uptake can recycle nitrogen. (Copyright 1977-Transactions of the ASAE)

4365-B2

HEAD LOSS OF BEEF MANURE SLURRY FLOW IN POLYVINYLCHLORIDE PIPE

Agricultural Engineer, John Deere & Co., East Moline, Illinois
M. J. Rolfes, C. B. Gilertson, and J. A. Nienaber
Transactions of the ASAE, V. 20, No. 3, p. 530-533, May-June, 1977. 7 fig., 12 ref.

Keywords: Cattle manure, Slurries, Head losses, Flow velocity, Total solids, Pipe size, Polyvinylchloride pipe.

Curves were developed for predicting beef manure slurry friction head losses as a function of flow velocity, TS content, and pipe size. Beef manure slurry friction head losses in PVC pipe are significantly greater than those for water. Loss ranges found were 1 to 4 m/100 m greater than water with 6 to 10 percent total solids, 2 to 6 m/100 m greater than water with 10 to 12 percent total solids, and 6 to 14 m/100 m greater than water with 12 to 15 percent total solids slurries, indicating that water head loss criteria are definitely inadequate for use in designing a slurry transportation system. Extrapolation of friction loss data to larger pipe sizes is possible as indicated by the friction head loss curve patterns of the three pipe sizes studied. (Copyright 1977 - Transactions of the ASAE)

4366-A4, A8, B2, B5, C2, E2

JOINT LAND SPREADING TRIAL

Department of Agricultural Engineering, Porter Building, The University of Newcastle Upon Tyne, Newcastle, England NE1 7RU
K. A. Pollock
Joint Land Spreading Trial, Final Report, University of Newcastle upon Tyne Agricultural Development and Advisory Service, April, 1974, 63 p. 4 fig., 10 tab., 7 ref.

Keywords: Slurries, Soils, England, Land spreading, Grassland management, Rainfall, Evapotranspiration, Water pollution, Grass yields, Nutrients, Application rates.

For 2 successive summers, on 2 widely separated one acre sites with different soil types, and located on commercial farms in Northumberland and Durham, slurry was spread on grassland following cutting for conservation. Drainwater from the sites was collected and analysed to assess the accuracy of soil moisture deficit estimates calculated from evaportranspiration and rainfall figures, and the likelihood of water pollution. Grass yields and soil moisture contents were monitored, and nutrient application and recovery were assessed under high levels of slurry application (up to 30,000 gal./acre/growing season). There were few periods when the soils were saturated, but the limited results indicate that the deficit calculations were reasonably accurate. At the levels used, nutrient recovery was low, although the grass yields were high. Lower application rates would probably improve efficiency of utilisation without decreasing yield appreciably. Very little water pollution was occasioned by slurry spreading at the high rates, and spreading at lower rates as a fertilizer treatment during the growing season would probably be free from significant pollution. (Pollock-University of Newcastle Upon Tyne)

4367-B2, C1, C2, D1, D2, D3, E3

METHANE FERMENTATION OF ANIMAL WASTES

Assistant Director, Northern Regional Research Center, Agricultural Research Service, U. S. Department of Agriculture, Peoria, Illinois 61603
D. L. Miller

Proceedings, Conference on Capturing Sun Bioconversion, Washington, D. C., March 10-12, 1976, p. 361-364.

Keywords: Methane, Refeeding, Cattle wastes, Anaerobic digestion, Fermentation, Chemical properties, Physical properties, Screening, Flocculation, Centrifugation, Poultry, Performance.

Methane and nutritious residual solids may be obtained from animal wastes that have been anaerobically digested. A laboratory size research operation was initiated in July, 1971 under a contract with Hamilton Standard Division of United Technologies, Windsor Locks, Connecticut, in which two 20-liter fermentors were operated continuously for 3 years with manure from concentrate-fed beef and dairy cattle. The general results were: (1) Standard conditions developed: 10 percent waste solids in input, periodic addition, 5-6 day retention time, 50°C., 8-16 g./L/day (0.5-1.0 lb./cu.ft./day) loading rate. Gas production average 0.4L/g. Input waste (8 cu.ft./lb.); 52 percent methane, 48 percent CO_2, trace H_2S, no H_2 or NH_3. (2) Volatile acids never exceeded 400 mg./L, indicating stable methanogenic population. (3) 50 percent input waste solids were destroyed during digestion; no N was lost. (4) About 50 percent of carbon in gaseous products came from cellulose-hemicellulose with remainder from more soluble components. There was no lignin breakdown. (5) Solubilization of cellulose rather than methanogenesis appeared to be rate-limiting. However, alkali or acid pretreatment of waste did not consistently improve gas yield. Addition of N-compounds, PO_4, carbohydrates, did not improve. (6) Most organic N in output was in suspended solids. Coarse screening left 80-90 percent of N in liquid; flocculation-centrifugation of this liquid recovered ca. 100 percent of organic N (NH_3 remained in liquid). (7) Digested solids contained 20-25 percent amino acids (dry basis); this was 2-4 times that of raw waste. Part of increase came from destruction of non-N materials in conversion to gas, some from conversion NH_3, etc., to cell protein by microorganisms. (8) Neither raw manure nor digested output material was well utilized by broiler chicks when used as a replacement for corn in a growing ration; NH_3 was thought a significant factor in limited utilization. Good nutritive value is expected when used by ruminants. Based on the results of the laboratory-scale research, further research was felt necessary for obtaining engineering and economic data. Such research is underway. (Bates-East Central)

4368-B2, C1, C2, D3, E3

ANAEROBIC DEGRADATION OF DAIRY MANURE UNDER MESOPHILIC AND THERMOPHILIC TEMPERATURES

Agricultural Engineering Department, University of Wisconsin, Madison, Wisconsin
J. C. Converse, R. E. Graves, and G. M. Evans

Transactions of the ASAE, V. 20, No. 2, p. 336-340, March-April, 1977. 1 fig., 7 tab., 10 ref.

Keywords: Anaerobic digestion, Dairy manure, Equipment, Design, Temperature, Detention time, Chemical properties, Physical properties, Methane, Gas production, Energy.

Anaerobic degradation studies for methane production were conducted using the following types of dairy manure, detention times, and temperatures: (1) feces - 15 days at 35°C and 60°C, (2) feces-urine-straw mixture - 15 days at 35°C and 60°C, and (3) feces-urine mixture - 10.4 days at 35°C and 6.2 at 60°. The manure was diluted with equal parts water giving a volatile solids concentration of the feed of approximately 6.5 percent. The loading rates ranged from 4.23 to 10.51 kg VS/m^3 of digester volume. For the mesophilic digester, gas production ranged from 1.28 to 1.66 m^3 gas/m^3 digester volume/day, with the percent methane ranging from 52.8 to 56.7 percent. Loading rates ranged from 4.26 to 6.22 kg VS/m^3 /d. Gas production for the thermophilic digester ranged from 1.06 to 2.59 m^3 gas/m^3 digester volume/day, with percent methane ranging from 49.2 to 54.5 percent. Loading rates ranged from 4.23 to 10.51 kg VS/m^3 /d. The VS and COD reductions dropped as the detention time decreased for both the mesophilic and thermophilic digesters. The feces-urine-straw mixture did not decompose readily in either digester. Gas production increased on volume/volume/day basis as the loading rate of the thermophilic digester was increased. The mesophilic digester gas production on volume/volume/day basis increased slightly as the loading rate increased, but VS and COD reductions decreased considerably. A minimum of 15 days detention time is recommended for mesophilic degradation. Net energy output averaged 69 percent of the gross energy output for the mesophilic digester at 15 and 10.4 day detention times, and 40.3 percent for the thermophilic digester at 6.2 day detention time. Heating the influent was the largest energy input. Methangenic bacteria numbers averaged 10^9 and 10^{10} per ml digester contents in the mesophilic and thermophilic digesers, respectively, during the evaluation of the feces-urine mixture. Over 95 percent of the total nitrogen was accounted for in the effluent. The average NH_3/TN ratio of the manure was 0.30 and 0.43 for the effluent for both digesters. Up to 0.014 mg NH_3N/liter of gas and 2.55 mg H_2S / as S/1 of gas was present in the off gas. (Rowe-East Central)

4369-B1, C1, C2

DECOMPOSITION AND NITROGEN LOSS OF DAIRY WASTES DEPOSITED ON SIMULATED ANIMAL CONFINEMENT SURFACE

Soil Science and Agricultural Engineering Department, University of California, Riverside, California
A. L. Chang and J. B. Johanson

Transactions of the ASAE, V. 20, No. 3, p. 523-526, May-June, 1977. 4 fig., 2 tab., 7 ref.

Keywords: Dairy wastes, Drylot dairies, Animal density, Moisture content, Temperature, Humidity, Physical properties, Chemical properties, Decomposition, Nitrogen, Chloride, Chemical oxygen demand, Fixed solids.

Dairy cattle waste deposition on unpaved drylot dairies was studied for 7 weeks under controlled laboratory conditions with different confinement animal density and moisture content of deposited wastes. Dairy cattle confinement areas were simulated by using 23 cm x 33 cm x 5 cm Teflon-coated aluminum trays. These simulated confinement surfaces were placed in a greenhouse compartment in which temperature and humidity were controlled to resemble the local summer climate. Although daily temperatures were allowed to fluctuate from 24°C to 35°C during the experiment, relative humidity was maintained not to exceed 30 percent. A well-stabilized dairy waste was spread evenly on each tray. Freshly collected dairy wastes were then added daily to each tray at a waste deposition rate equivalent to an animal density of 93, 47 and 23 m^2 of confinement surface per animal in the field. In a second set of trays, urine from dairy cows was added in addition to fecal matter at the rate described above. To study the effect of moisture content of deposited wastes on decomposition, the experiment described above was repeated, but deposited wastes were maintained at 45 percent moisture content. There were a total of 12 treatment combinations during the entire experiment. At the end of each week, samples were taken for analysis of moisture content, nitrogen content, chemical oxygen demand (COD), chloride and fixed solids(FS). The decomposition of waste solids during waste deposition was influenced by both animal density and moisture content. A greater percent of solid loss was observed at low animal density and high moisture content. When urine fecal matter were added together to experimental trays, a lower percentage of total solids was decomposed, probably due to higher fixed solids content in the urine fraction. The loss of total nitrogen from accumulating wastes was significant for all treatments. When urine was not added to deposited wastes, the percentage of nitrogen loss decreased with increasing animal density. If both fecal matter and urine were present, high percentages of nitrogen loss were observed in all treatments. Moisture content did not affect the loss of total nitrogen. When stability of deposited wastes was evaluated using both chemical oxygen demand to fixed solids (COD/FS) and total nitrogen to fixed solids (TN/FS) ratio, it was apparent that deposited waste was not completely stabilized during waste accumulation. Further decomposition of organic solids and loss of nitrogen would continue when waste was removed from confinement area. (Bates-East Central)

4370-B3, D1, D2, E3
FEEDLOT MANURE: THE ECOLOGY INSPIRED BUILDING MATERIAL

Anonymous
Calf News, V. 9, No. 9, p. 12, Sept., 1971. 1 fig.

Keywords: Recycling, Ecolite, Building materials, Cattle manure, Broken glass, Waste treatment.

Ecolite is a new building material which can be molded to any shape, have any desired consistency, is 5 times as light as concrete blocks, is fireproof, can be cut with an ordinary saw, will take a nail, and will sell at an attractive price. Richard and Charles Kershaw of Brawley, California provided the incentive and the materials for the product and John Mackenzie of the University of California in Los Angeles supplied the idea. Ecolite is a combination of Treated Cow Dung (TCD) and broken glass. The TCD, collected from conventional feedlots, is put through a kiln at high temperatures. There is no smoke and no odor to this process. Thus no new ecological problems are created. The volume is reduced 50 to 75 percent. Melted glass is added to the TCD. The proportion of glass to TCD determines the physical properties of the Ecolite. The Kershaws and Mackenzie are forming a corporation and plan to build a pilot manufacturing plant, probably adjacent to the Kershaw feedlot in Lovington, New Mexico. Mackenzie is also exploring his discovery's application to human waste problems. (Bates-East Central)

4371-A9, A10, A11, B1
SANITATION IS FIRST STEP IN EFFECTIVE FEEDLOT FLY CONTROL

Staff editor, Feedlot Management
G. Lamp
Feedlot Management, V. 19, No. 7, p. 13-17, July, 1977. 6 fig.

Keywords: Fly control, Feedlots, Sanitation, Chemical control, Biological control, Performance, Insecticides.

Feedlot fly control was studied by Bill Clymer. Clymer suggested these points to feeders that they could do before resorting to chemical control. (1) To prevent areas where waste builds up, design feedlots for easy waste removal. (2) Stock pens to increase trampling and reduce breeding areas. (3) Correct leaky water faucets so water doesn't collect in areas where fly breeding could become popular. (4) Clean horse pens since they are perfect for fly breeding. (5) Keep receiving pens clean. (6) Pay special attention to receiving-shipping areas, sick pens and washing areas. (7) Correct improper pen drainage to avoid pothole breeding areas. (8) Be sure leaky sprinkler heads don't cause wet spots if sprinkling to control dust for heat stress. There is quite a different in cost of gain if flies are not controlled. Research was conducted as to exactly what fly infestations cost cattle feeders. Data showed that for cattle on a growing ration, the population level of 50 flies per animal accounted for a difference of about 0.2 lb./day in weight gain of those cattle bothered by flies as opposed to those that had no flies. There was a 13 percent better feed efficiency in the growing ration cattle without flies as those cattle with flies. There was 11 percent better efficiency for the finishing ration. Windbreak trees, weeds and structures built within pens provide the best fly resting areas. Drainage areas and debris settling areas are areas most suited for breeding. The common house fly and the stable fly are the major flies causing economic damage in the feedlot. The chemical approaches to the fly problem are: (1) Residual sprays - chemical treatments applied where adult flies congregate. The spray should be applied every 10-15 days throughout the summer. (2) Space sprays - sprays that kill flying adults on contact. It lasts up to 3 hours. (3) Biological control - using other host parasites to feed on the already present pests. The most successful fly control method found is the utilization of a space spray mist blower, which dribbles insecticide into an air stream and blasts it into the feedyard. (Rowe-East Central)

4372-A11, B1, B3, E3
A NEW CONCEPT OF LITTER MANAGEMENT FOR BROILER PRODUCTION

Agricultural Engineering Department, University of Georgia, Athens, Georgia
R. H. Brown, E. S. Howell, and B. D. McLendon
Transactions of the ASAE, V. 20, No. 2, p. 345-347, March-April, 1977. 3 fig., 3 tab., 6 ref.

Keywords: Poultry, Litter depths, Ventilation, Moisture content, Performance, Fertilizers, Refeeding.

Chick performance and the litter characteristics as a function of initial depth of litter (wood shavings) for broilers grown in a totally enclosed, fan-ventilated house with an electrically-heated concrete floor were studied. Litter moisture, amount, handling characteristics, and possible reuse; along with kilowatt-hour requirement per chick, breast blisters, feed conversion, mortality and 8-week weight of broilers were factors to be measured. Conventional husbandry practices were used in all trials. These included feed and water "ad libitum," normal vaccination for Newcastle and bronchitis and continuous light at 1.5 average Fc. The wood shavings depths trials were conducted in spring and summer and showed significantly lower moisture contents for shavings versus no shavings. Nevertheless, the zero-shavings final moisture content was well below the 35 percent level where ammonia levels in the air and flies became troublesome. It was concluded that zero-shavings was quite acceptable so far as moisture content and the economic advantages make this level of litter the obvious choice. There were no significant differences in breast blisters, feed conversion or growth rate as a result of initial depth of litter. Other studies involving 8000 broilers showed that no initial litter of any kind was required for growing broilers on a heated concrete floor. The values for feed conversion, growth rate, mortality and litter moisture compared favorably, equal or better to conventional records of the broiler industry; therefore, the most economical condition was no litter at all. Total kilowatt-hour usage for lighting, ventilating, brooding, unloading, and clean-up of waste (droppings plus litter) averaged 1.93 kilowatts per chick per 8 weeks for the 0-inch depth and the 2-in. depth of litter and 2.87 kWh for the 4-in. and 6-in. depths. The greater depths caused excessive heat losses downward from the concrete floor. Droppings where no shavings were used resembled a sand/soil mixture. The dry, waste-material consisted of manure, wasted feed, and feathers. It was easily pushed along the concrete floor with a 4-ft dozer blade pwoered by a garden-size tractor. The best unloading method was to push the waste onto a conveyor belt located in an 18-inch deep tunnel from which the wastes were transferred to an inclined belt conveyor for loading into a truck or wagon. Once the feathers were removed by screening, the remaining manure could be used as a fertilizer or for refeeding. (Rowe-East Central)

4373-B2, C2, D2, D3, E3
AMMONIA SYNTHESIS GAS AND PETROCHEMICALS FROM CATTLE FEEDLOT MANURE

Texas Tech University, Lubbock, Texas 79409
W. J. Huffman, J. E. Halligan, R. L. Peterson, and E. de la Garza
Symposium on Clean Fuels from Biomass, Orlando, Florida, Jan. 27, 1977, 29 p. 8 fig., 7 tab., 29 ref.

Keywords: Cattle manure, Feedlots, Recycling, Pyrolysis, Oxidation, Reactors, Design, Ethylene, Petrochemicals, Tar, Ammonia Synthesis gas.

The pyrolysis and partial oxidation of cattle feedlot manure are discussed in this paper. Previous studies by the investigators as well as the pioneering work of R. C. Bailie are reviewed. A description of the current reactor which has a throughput of one-half ton per day and experimental results on the simultaneous production of 0.4-1.2 liter ammonia synthesis gas per g. of dry ash-free manure and 25-65 kg ethylene per metric ton of dry ash-free manure are given. A basis for the production of the ethylene and other petrochemicals is discussed along with recent results on the decomposition of intermediate tar and liquids. The application of process technology to other feedstocks, use of oxygen instead of air, and a discussion of different reactor designs are also presented. (Huffman-Texas Tech University)

4374-A11, B3, C2, C3, D3, E3
NUTRITIONAL VALUE OF CATTLE WASTE FOR CATTLE

Department of Animal and Dairy Science, Auburn University, Auburn, Alabama 36830
W. B. Anthony
Federation Proceedings, V. 33, No. 8, p. 1939-1941, Aug., 1974. 26 ref.

Keywords: Refeeding, Cattle manure, Wastelage, Performance, Sanitation, Ensiling, Ewes, Cattle.

The improvement of sanitation in cattle feeding areas and the feed efficiency for producing slaughter beef was studied. Manure collected from cattle full-fed a high energy feed and housed on concrete was washed and separated into liquid and fibrous phases. The liquid phase was usually discarded. The washed fiber was blended with a basal mixture and fed to cattle. Yearling cattle consumed the ration readily and made a daily live weight gain of 3.39 lb. on 6.43 lb. of feed dry matter. Holstein bulls were fed a similar mixture with success. Two additional feeding trials used manure collected directly from the feeding floor and blended with a basal high energy mixture in the ratio of 1-1.5. Similar success was found. No advantage was shown for washing or cooking manure prior to feeding. Experiments were carried out in which manure was harvested and blended with feed ingredients and stored as silage.

The ensiling process proved a very valuable and efficient means of using cattle manure as feed for cattle. Wastelage was created by combining 57 percent ensiled cattle manure mixture with 43 percent hay. In feeding trials using wastelage vs. coastal hay, wastelage-fed ewes remained in excellent physical condition throughout the feeding trial and they were noticeably more alert than animals maintained on coastal bermudagrass hay. Mineral supplements had been given both groups of animals. In a similar trial utilizing beef breeding cattle, wastelage diets supplemented with a protein-mineral-vitamin A supplement were compared to corn silage diet supplemented with a protein-mineral-vitamin A supplement. While the wastelage proved to be a valuable ration and did not adversely affect animal health, the corn silage rationed cattle had more energy and gained better. Other rations utilizing ensiled mixtures proved successful also. Since the manure had feeding value, the animals are not adversely affected by continuous consumption of the mixtures, cattle carcasses from manure and non-manure containing feeds possess the same high quality, feed efficiency is enhanced, more human food is produced, and manure is managed so that it does not pollute the environment and manure feeding should be considered sufficiently valuable to all society. (Rowe-East Central)

4375-A11, A12, B1, C3

THE DEVELOPMENT IN BEEF CATTLE MANURE OF *PETRIELLIDIUM BOYDII* (SHEAR)MALLOCH, A POTENTIAL PATHOGEN FOR MAN AND CATTLE

Research Station, Agriculture Canada, Lethbridge, Alberta, Canada T1J 4B1
R. G. Bell
Reprint, Canadian Journal of Microbiology, V. 22, No. 4, p. 552-556, 1976, 1 tab., 15 ref.

Keywords: Mycoflora, Fungi, Feedlots, Cattle, *Petriellidium boydii*, Animal health, Public health.

Petriellidium boydii (*Allescheria boydii*) dominated the mycoflora of manure samples from three beef cattle feedlots after incubation at room temperature for 4 months. The possible dangers associated with this pathogenic fungus, which causes mycotic abortion in livestock, pulmonary allescheriasis in man, and mycetomas in both man and animals, are discussed. This fungus could create a health hazard in feedlots where *in situ* manure decomposition is encouraged. (Copyright 1976-Canadian Journal of Microbiology)

4376-A11, B1, C1, C2, E3

USE OF FLUID COWSHED MANURE IN FISH PONDS

Fish and Aquaculture Research Station, Dor, Israel
G. L. Schroeder
Bamidgeh, V. 26, No. 3, p. 84-96, 1974. 6 fig., 5 tab., 4 ref.

Keywords: Israel, Refeeding, Fish, Ponds, Cattle manure, Fish kills, Fish growth, Biochemical oxygen demand, Chemical oxygen demand, Dry matter, Dissolved oxygen.

Manure is often used as a fertilizer for fish ponds. The decay of the manure in the pond consumes dissolved oxygen (D.O.) and can lower the D.O. to a level at which fish kill by anoxia occurs. To determine the effects of fluid cowshed manure on fish ponds, the cycles of D.O., abundance and protein content of natural foods, and fish growth were studied in a group of ponds receiving varied amounts of manure. The manure was analysed for 1 day and 5 day biological oxygen demand (BOD_1, BOD_5) at pond temperature, chemical oxygen demand (COD), and percent dry matter. No foods or fertilizers other than manure were added to the ponds. Determining BOD_1 of the manure at pond temperature consistently allowed prediction of the maximum amount of oxygen that decay of manure would use and the maximum overnight reduction of D.O. in the pond water due to the added manure. This permitted calculation of the amount of manure able to be added to a pond without hazard of causing anoxia. For a given source of manure, the percent of dry matter was a fair indicator of BOD_1. Abundance of natural foods (zooplankton and chironomides) was greater in ponds receiving manure than in non-manured ponds. The zooplankton had a 56 percent protein content on a dry weight basis. For rates of about 5,000 fish per hectare preliminary data indicate that growth of carp was 25 percent to 100 percent faster in manured ponds than in non-manured ponds. With no supplemental food, in manured ponds, carp stocked at 18 gm averaged a growth rate of 3.3 gm/day for 40 days during the summer. Carp stocked at 180 gm averaged a growth of 4.0 gm/day during March. (Copyright 1974-Bamidgeh)

4377-A8, B5, C1, C2, E2

EFFECT ON SOIL AND PLANT MINERAL LEVELS FOLLOWING APPLICATION OF MANURES OF DIFFERENT COPPER CONTENTS

Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
E. T. Kornegay, J. D. Hedges, D. C. Martens, and C. Y. Kramer
Plant and Soil, V. 45, No. 1, p. 151-162, 1976. 5 tab., 10 ref.

Keywords: Swine manure, Land application, Feed additives, Copper, Corn, Crop response, Soil chemistry, Ion movement, Nutrients.

The effect of application of manure containing a relatively high level of copper on growth and nutrient composition of maize (*zea mays* L.) and ion movement in soil was determined. Manure collected in 1972, 1973, and 1974 from finishing pigs fed a fortified 15 percent protein maize-soybean meal diet either with or without a growth stimulating level of copper (250 ppm in 1972, 370 ppm in 1973, and 300 ppm in 1974) was stored in plastic containers until enough manure had accumulated for one block of the 3-block field experiments. The following treatments were randomly assigned to plots within each block: (1) no manure applied; (2) control manure applied from pigs fed ration without added copper; (3) high Cu manure applied from pigs fed rations containing growth stimulating levels of copper. Using a rotary tiller, the manure was applied to a 10 cm depth between 10 cm high rows of corn. Manure containing an average of 21.6, 22.0 and 24.0 percent dry matter was applied at the rate of 71.9, 58.8, and 65.6 metric tons per hectare to a Groseclose silt loam soil. Average manure composition on a dry basis for the 3 years was 3.6 nitrogen, 2.87 percent calcium, 0.93 percent magnesium, 2.22 percent phosphorus, 1.30 percent potassium, 648 ppm zinc, and 2191 ppm iron. Copper content was 73 ppm for control manure and 1719 for high copper manure. High copper manure significantly increased copper content in the upper 10 cm of the soil each year. Plowing after the first year increased the copper level in the 10-20 cm depth with a small increase in the 20-30 cm depth. Manure application increased potassium, zinc, phosphorus, calcium and magnesium levels of the soil. While application of high copper manure caused some increase in copper found in maize ear leaf and in roots of mature maize plants, copper content of the grain was no different from that of grain from soil receiving no manure. Zinc, potassium and phosphorus contents of the maize ear leaf were marginally increased when both control and high copper manure were applied and potassium and phosphorus content carried over into the grain. Application of control and high copper manure caused some decrease in calcium content of the grain. (Rowe-East Central)

4378-B2, C2, D3, E3

140° IS CRITICAL -- METHANE FROM CATTLE WASTE FERMENTATION STARTS RAPIDLY, CONTINUES STEADILY

University of Illinois
V. H. Varel, H. R. Isaacson, R. A. Frobish, and M. P. Bryant
Confinement, V. 2, No. 6, p. 16, June, 1977.

Keywords: Recycling, Methane, Cattle wastes, Fermentation, Fertilizers, By-product recovery, Refeeding.

With the potential benefits of reducing the huge amounts of feedlot manure and supplementing the diminishing supply of natural gas, research is being conducted on the microbiology and biological potential of methane production from cattle wastes. Initially, 3-liter reactors were used to study the fermentation process. It was found that the complex of bacteria species necessary for fermentation at 140°F was present in fresh cattle manure. Previous research done by John Pfeffer showed that biological production of methane from municipal refuse was most rapid at a thermophilic temperature of about 140°F. This was corroborated as an efficient temperature in the cattle waste study. A vigorous fermentation was established within about 12 days after start-up with proper daily loading, mixing, and control of acid. The retention time for the reactor contents ranged from 3 to 15 days. The gas produced at 140°F had a relatively constant methane content of 54 percent to 58 percent. Experiments were done to measure the efficiency of methane production with increasing concentrations of wastes. Reactors were established at different retention times (3, 6, 9, and 12 days) with a relatively low concentration of waste organic matter in water. Based on volume produced per unit of weight of organic matter fed, methane production efficiencies were progressively lower in the reactors maintained at the shorter retention times. Another measure of the efficiency of methane production is the volume of methane produced daily per unit to reactor volume. On this basis, efficiency was greatest in reactors receiving about 8 percent organic matter and set at the 3-day retention time. About 4.5 liters of methane/day/liter of reactor volume was produced. The fermentation is also valuable because: (1) Feedlot wastes, when combined with municipal wastes, provide the necessary minerals for bacterial growth. (2) The reactor effluent has increased value as a fertilizer. (3) The effluent also can be refed to nonruminants as a protein source. According to studies now in progress, dairy cattle wastes are not as efficiently converted into methane as those from feedlot cattle. (Bates - East Central)

4379-A11, C1, C2, E3
INFLUENCE OF RECYCLING BEEF CATTLE WASTE ON INDIGESTIBLE RESIDUE ACCUMULATION

Oklahoma Agricultural Experimental Station, Stillwater, Oklahoma 74074
D. G. Wagner, B. A. Ackerson, and R. A. Johnson
Environmental Protection Agency Report EPA-600/2-77-175, Aug., 1977, 73 p. 3 fig., 41 tab., 20 ref.

Keywords: Refeeding, Cattle wastes, Digestibility, Nutrients, Roughage value, Palatability, Cattle, Performance, Nitrogen, Indigestible residue accumulation.

Studies were conducted to investigate the effect of feces recycling in beef cattle diets (rations) on the digestibility of various dietary nutrients and on the accumulation of indigestible residues. Feces were refed in three successive phases based primarily upon the quantity of feces produced in the previous phase. Several different roughage levels in high concentrate rations were considered. An attempt was made to investigate the digestibility of various nutrient parameters in feces when refed and the roughage value of feces. Mineral retention data and the accumulation of various minerals in the fecal and urinary residues were studied. Varying levels of feces in growing/maintenance rations were investigated along with the efficiency of urinary nitrogen (N) as a supplemental N source. (Wagner-Oklahoma Agricultural Experimental Station)

4380-A11, B3, C1, C3, D3, E3
WINTERING BROOD COWS MAKE BEST USE OF POULTRY LITTER: RESEARCHER

Anonymous
Feedstuffs, V. 49, No. 34, p. 12, 14, Aug. 15, 1977.

Keywords: Refeeding, Poultry litter, Ensiling, Cattle, Moisture content, Bacteria, Performance.

Dee L. Cross, Clemson University animal scientist, says that poultry litter may be used for cattle feed primarily because cattle have the ability to digest much of the fiber in litter and to utilize the nitrogen from uric acid in the litter to synthesize protein. Initially at Clemson, poultry litter was artificially dried before refeeding. Because this was costly and energy-consuming, mini silos were created for ensiling. Hardwood bark litter was found to ensile better than soft wood bark litter. Moisture content of 35-40 percent for a minimum of 6 weeks was required for ensiling. Clemson workers found after ensiling 115 tons of litter that a tremendous reduction in total bacterial content occurred and potential pathogenic bacteria were nondetectable. Feeding of poultry litter was found to offer the most profitable benefits to wintering brood cows. Feeding of ensiled litter to dairy heifers, beef steers, and to mature beef cows resulted in reduced feed costs. Ensiled litter was an effective feed source in steer diets containing up to 50 percent litter. There were no deleterious effects on carcass quality or taste acceptability of meat. Much higher levels of litter can be used for wintering brood cows. (Rowe-East Central)

4381-A8, B2, C2, D3, E2
SALT REMOVAL EFFICIENCIES ON LAND DISPOSAL OF SWINE WASTE

Department of Animal Science, Alcorn State University, Lorman, Mississippi
H. E. Grier, G. C. Gupta, and S. C. Tiwari
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, V. 104, No. EE4, p. 551-556, Aug., 1977. 2 fig., 1 tab., 11 ref.

Keywords: Land disposal, Swine wastes, Liquid wastes, Sampling, Removal efficiencies, Nitrates, Ammonia, Chloride, Suspended solids, Biochemical oxygen demand.

A study was done to determine the removal efficiencies for nitrate (NO_3-N), ammonia (NH_4-N), chloride (C1), suspended solids, and biochemical oxygen demand (BOD) on the land disposal of swine waste effluent. The effect of time (prolonged land disposal of waste effluent on alternate days up to 6 months) on these removal efficiencies was also studied. The management system included a feeder pig-swine finishing operation and 2 lagoons--one aerobic and the other anaerobic. The type of soil used for disposal was a Memphis silt loam, with highly weathered mixed clay minerals, having medium infiltration and percolation rates. The research area was divided into 12 plots with grass work area between each plot. Common Bermuda (Cynodon dactolyn) grass was grown on these plots. Four replications of the 3 spraying treatments [0.2 in. water, 0.1 in. water and 0.1 in. effluent, and 0.2 in. effluent per application] were used on alternate days. Samples were collected monthly from barrels at the bottom of sloped V ditches on the research plot and from the aerobic lagoon and were analyzed on the same day. The conclusions drawn from this study were: (1) The land disposal system approach of swine waste effluent designed in this study, for treatment of less than 1 in. of waste effluent/week, was efficient for decreasing the salts, suspended solids, and BOD concentration of the waste effluent for this system. (2) There was a large difference between the removal efficiencies for NO_3-N and NH_4-N. The swine waste effluent had over 3 times more NH_4-N than NO_3-N but still the rate of NH_4-N removal was higher. (3) Removal efficiency for NO_3-N decreased from 62 percent to 32 percent with time as more and more swine waste effluent was disposed on the land. This drop was probably caused by the increased matter accumulation in the soil matrix. (4) Removal efficiency of C1 was similar to NH_4-N and did not show much change with prolonged land disposal of the swine waste effluent. (5) BOD removal efficiency of 95 percent was high and remained constant because of the low application rate of less than 1 in./wk. (6) This system became "overloaded" in NO -N removal long before it showed any similar signs for BOD removal. (Bates-East Central)

4382-B2, D2, D3, E3, F1
RESEARCHERS STUDY ALGAE PRODUCTION FROM HOG WASTE

J. D. Kendall, editor
Feedstuffs, V. 49, No. 32, p. 13, 28, Aug. 1, 1977.

Keywords: Recycling, Wastewater renovation, Odor control, Swine wastes, Algae production, Refeeding, Anaerobic lagoon, Flocculation, Economics, Protein.

At the University of Florida, researchers are using the continuous mass culture of algae with swine wastes as a nutrient source and then refeeding the algal product. The project is housed in a 300-sow, year-round unit. Wastes from the confinement area of the unit are flushed into an anaerobic lagoon of 6 million liter capacity at an average rate of 8000 liters/day. The effluent from the lagoon is gravity fed into the algal growth unit, which consists of four unlined, earthen channels in a parallel array connected by culverts at alternate ends to form a continuous course. A dense algal population is produced after a minimum of 4 days of movement through the channels. The algae is then harvested. This is the most difficult phase of the operation and the main focus of this research. The present system uses chemical flocculants in dilute water solutions (which are quite expensive) such as aluminum sulfate, aluminum chloride, ferric sulfate and an organic polyelectrolyte, that are added to the culture, which has been drawn off by a centrifugal pump. The algal slurry is then either acidified to remove the flocculant and then resettled, or pumped directly onto the drying tables. After drying, the product is easily removed as hard green flakes that can be stored indefinitely and can be ground to a meal. An amino acid analysis of a sample of alum flocculated algae gave a spectrum very much like that of soybean meal and a protein content of 39.7 percent. The total algal yield (390 lbs) of this experiment, which was lower than the maximum yield possible, compares with 390 lbs. or soybeans that could be grown on the same size area (1/5 acre). The algal product, which costs between \$17 to \$170/ton is economically competitive with soybean meals, which cost up to \$325/ton. As a further benefit, algal production is a low cost means of wastewater renovation by oxygenation of the medium and dissolved nutrient removal. Waste grown algae also removes the odor from the waste almost immediately after the culture growth is initiated. Furthermore, the algal yield is continuous and nonseasonal in mild climates, and a new crop can be brought to harvest in a matter of a few days. (Bates-East Central)

4383-A1, B2, B3, B4, D3, E2, F1
WHAT ARE YOU DOING ABOUT YOUR 1.57 BILLION TON ANIMAL WASTE PROBLEM?

Anonymous
Farm Technology, V. 28, No. 3, p. 14, 16, 1972.

Keywords: Waste management, Liquid wastes, Solid wastes, Scraping, Pumping, Aerobic treatment, Anaerobic treatment, Waste storage, Land spreading, Economics.

While today's methods of animal waste management may temporarily suffice, improvements are constantly needed. Unfortunately if the improvements are not made voluntarily, even stricter laws and regulations will be passed. Animal waste management has been redefined to reflect the following trends: (1) increasing animal confinement in large numbers and in areas of high animal density, (2) movement of non-farm people into livestock production areas, and (3) increased concern on the part of the public for a cleaner environment. Animal waste management systems are being sought that will make odor and water pollution control possible without sacrificing efficiency and economy of operation. Solid wastes are usually removed by mechanical scraping with tractor mounted front-end loaders, cable-drawn blades, and similar machinery. Conveyors and pipes utilizing a pneumatic system may also be used. Liquid animal wastes may be hosed or flushed to a holding place or pumped through pipes. In some cases, the liquid wastes drain by gravity flow to a pit or tank. If slatted floors are used, the wastes are deposited through the slats into a storage pit containing water. Solid wastes may be composted or air dried. Liquid wastes may be stored in anaerobic pits, anaerobic lagoons, or oxidation ditches. Spreading manure over the land for crop fertilization and soil conservation is the most common disposal method for solid wastes. Liquid manure may be spread and plowed under or may be pumped through pipes for sprinkler application of growing crops. Advantages of solid manure handling are: (1) With regular spreading, there is no accumulation of solid manure as with liquid. (2) Odor is minimized. (3) Investment in facilities is less with liquids. Advantages of liquid manure handling are: (1) Year-around storage is possible with adequate storage tank capacity. (2) Milk house and parlor wastes can go into liquid storage facilities. (3) The maximum amount of nutrients can be retained if liquid manure is incorporated into the soil shortly after application. (Merryman-East Central)

4384-A6, B2, C1, C2, C3, D3
STATE OF THE ART - ANAEROBIC LAGOONS

Department of Civil Engineering, South Dakota State University, Brookings, South Dakota
J. N. Dornbush
Second International Symposium for Waste Treatment Lagoons, Kansas City, Missouri, June 23-25, 1970, p. 382-387. 27 ref.

Keywords: Lagoons, Waste treatment, Anaerobic conditions, Design, Farm wastes, Municipal wastes, Industrial wastes, Temperature, Sludge, Bacteria, Mixing, Loading rates, Detention time, Odor.

Anaerobic lagoons have been used successfully to treat municipal and industrial wastewaters was well as manure slurries from livestock feeding operations. Anaerobic lagoons which operate satisfactorily achieve 60-80 percent BOD reduction. With effluent BOD concentrations of 100-500 mg/1, depending largely upon the raw waste, effluents must receive further treatment prior to discharge to a receiving body of water. Usually the additional treatment is provided by oxidation ponds. Design criteria for anaerobic lagoons which have been used in the United States and in other countries are discussed. The impact of temperature, covers, inlets, loading and detention time, and solids content are examined in relation to their effect on such lagoons. It was determined that research activities should be directed at more clearly defining: (1) the thermal environment throughout lagoons, (2) the nature of the organics in both the lagoon influent and effluent, (3) the actual detention time or organics within the lagoon, and (4) the relative importance of sludge accumulations as a major source of nuisance odors. With this information, design criteria that would result in a satisfactory waste-stabilizing environment within the lagoons can be established. (Rowe-East Central)

4385-A8, B1, C2, E2
WASTES: USE OR DISCARD?

Agricultural Research Service, U. S. Department of Agriculture, Bushland, Texas 79012
B. A. Stewart and R. L. Chaney
Reprint from Proceedings of the 30th Annual Meeting, Soil Conservation Society of America, San Antonio, Texas, Aug. 10-13, 1975, p. 160-166. 6 tab., 26 ref.

Keywords: Agricultural wastes, Land disposal, Nutrients, Nutrient losses, Nutrient availability, Nitrogen, Salinity, Leaching, Heavy metals.

Three primary considerations in utilizing wastes in crop production systems are: (1) Nutrient content of the wastes must be determined. (2) Nutrient losses from the wastes must be prevented prior to incorporation into the soil. (3) The rate that the nutrients in the waste become available for crop uptake must be determined. Immediate incorporation of wastes into the soil when they are spread prevents nutrient loss. Nutrients in animal manure and sewage sludges are not as available for plant uptake as chemical fertilizers. This is particularly true for nitrogen because often only 30-40 percent of the total nitrogen becomes available during the first year. Use of decay series statistics should be very useful in planning waste utilization programs. Excess nitrogen and salts from applied wastes can be hazardous to crop production and should be carefully monitored. Dilution of one part of feed-yard runoff with at least 4 parts water can help prevent salinizing disposal areas receiving such runoff. Salinity problems can sometimes be prevented by proper timing of waste applications. When feasible, the wastes should be applied several weeks before seeding. Depending on type and origin, wastes which are available for use on land may contain undesirable levels of trace elements. In contrast with the relatively rapid leaching of salts and nitrates, heavy metals persist in the surface soil. If applied in excess, these metals may become a long-term soil management problem. Recommendations for maximum metal loadings must take into account the relative phytotoxicity of Zn, Cu, and Ni, soil pH effects, crop differences, and other soil properties. (Merryman-East Central)

4386-B2, B4, C2
DIETARY ARSENIC EFFECTS ON STORED SWINE WASTE

Purdue University, West Lafayette, Indiana
M. C. Brumm, A. L. Sutton, and V. B. Mayrose
Journal of Animal Science, V. 42, No. 5, p. 1340, May, 1976.

Keywords: Feed additives, Arsanilic acid, Swine wastes, Anaerobic pits, Chemical properties.

A complete random design experiment was conducted to compare the effect of arsanilic acid as a feed additive on swine waste composition as excreted and stored in anaerobic pits. Three corn-soybean diets with 0 (A), 100 (B), and 200 (C) ppm of arsanilic acid were fed to growing-finishing pigs from 15.4 to 90 kg in two trials. Six pigs per pen were housed on slotted floors with total waste collection. Average daily waste production per pig, including hair, dust, wasted feed, waste water and excreta, was 3.62 kg for the winter trial and 4.77 kg for the summer trial. Mean waste production for the two trials as a percent of live weight ranged from 15.0 percent at 13.6 to 27.2 kg live weight to 6.7 percent at 66 to 90.5 kg live weight. The average nutrient composition (wet basis) of the fresh waste for both trials for all treatments was similar except for arsenic content which was (percent) A-.0000, B-.0011 and C-.0018. The mean nutrient composition (wet basis) of the waste in the pits for both trials for A, B, and C, respectively, was (percent): Kjeldahl nitrogen, .35, .32, .29; phosphorus, .09, .07, .05; potassium, .24, .22, .23; dry matter, 5.05, 3.18, 2.84; volatile solids, 4.02, 2.40, 2.12; arsenic, .0001, .0006, .0011; and pH, 7.07, 7.15, 7.22. The presence of arsanilic acid in the diet increased the percent nitrogen ($P < .05$) (dry basis) (A-7.18, B-10.32, C-11.17) and arsenic ($P < .05$ and decreased the percent dry matter ($P < .05$) and volatile solids ($P < 025$ in the anaerobic pits in the winter trial and increased the percent arsenic (dry basis) ($P < .025$) in the summer trial. (Copyright 1976-Journal of Animal Science)

4387-A7, A11
EXPOSURE OF LAMBS TO ATMOSPHERIC AMMONIA

University of Illinois, Urbana, Illinois
J. G. Drummond, S. E. Curtis, J. M. Lewis, F. C. Hinds and J. Simon
Journal of Animal Science, V. 42, No. 5, p. 1343, May, 1976.

Keywords: Sheep, Animal health, Air pollution, Ammonia, Weight gain, Feed conversion.

Two trials were conducted to determine the effects of chronic exposure to atmospheric ammonia at a concentration of 75 ppm on weight gain and efficiency of feed conversion by lambs. Lambs were weighed and then randomly allotted to four dynamic air-pollutant exposure chambers. Initial weights (mean $\pm$SE) of lambs were 22.1 $\pm$ .46 kg and 27.5 $\pm$ 1.54 kg for trials 1 and 2, respectively (n = 12 in both trials). Lambs in two chambers (controls) were maintained in an atmosphere of filtered room air. Lambs in the other two chambers (NH_3-exposed) were exposed to an atmosphere of filtered air plus atmospheric ammonia at a concentration of 75 ppm. Exposure period was 28 days in both trials. Feed and water were available at all times. Lamb weight gain and feed disappearance were determined weekly. Upon termination of each trial, one lamb was randomly selected from each chamber, sacrificed, and gross and histopathologic structural changes noted. Weight gain and efficiency of feed conversion data for the two trials were combined for statistical analysis. Control lambs gained on the average .09 kg/day (.28 vs. .19) more ($P < .01$) and consumed on the average .68 kg of feed (4.53 vs. 5.21) less per kilogram of weight gain ($P < .10$) than did NH_3-exposed lambs. Ammonia-exposed lambs in both trials showed profuse lacrimation, severe coughing and sneezing, and profuse nasal discharge, which was bloody in some instances. Gross and histopathologic findings appeared to be qualitatively similar between treatments, but more pronounced in NH_3-exposed lambs. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4388-A8, B2, B5, E2
2,057 POUNDS OF BEEF PER ACRE FROM FORAGE

B. Buchanan
Progressive Farmer, V. 92, No. 8, p. 22-23, Aug., 1977. 4 fig.

Keywords: Texas, Swine wastes, Land application, Liquid wastes, Irrigation, Coastal bermudagrass, Pasture, Cattle.

Albert Maberry and Johnny Edmondson of Texas found that a side benefit of land applying hog wastes from a 1,000-sow-capacity farrow-to-finish confinement operation was that they could produce 82,315 pounds of beef on 40 acres of Coastal bermudagrass pasture. Maberry and Edmondson applied about 3,000 gallons of swine waste per acre with a liquid manure spreader made from a railroad tank car once each month. Then they applied 2 inches of water with a wheel-move irrigation rig. The conclusions they found were: (1) The ''blow sand'' in West Texas was productive. Through use of swine waste, water, Coastal bermudagrass, and livestock, this land was made useful. (2) The soil seemed to stay warmer with waste than without it. Consequently, the grass had a longer growing season. They also felt the waste helped eliminate weeds in the pasture either by burning them or by creating a lush growth that crowded them out. (3) They also found out by an accidental fire, that the grass that burned started growing earlier and quicker in the spring. (Rowe-East Central)

4389-A11, B3, C2, D3, E3

NUTRITIVE VALUE OF ENSILED CATTLE WASTE

The Pennsylvania State University, University Park, Pennsylvania 16802
H. W. Harpster, T. A. Long, C. M. Lalonde, and W. W. Saylor
Journal of Animal Science, V. 42, No. 5, p. 1343, May, 1976.

Keywords: Ensiling, Cattle manure, Refeeding, Cattle, Sheep, Nutrients, Performance.

The nutritive value of ensiled cattle waste (ECW) was examined in steer growth (Trial 1) and sheep metabolism (Trial II) studies. Preliminary chemical analyses of ECW (60 percent fresh manure, 40 percent chopped grass hay) and corn silage, which served as a control, were: crude protein (percent) 16.5, 8.8; Acid Detergent Fiber (percent) 40.1, 28.0; lactic acid (percent) 3.89, 2.51; pH 4.5, 4.1. In Trial I, 48 steers (258 kg) were equally divided by weight and assigned to each of six pens in a 200 day, three-period feeding trial. Period I rations included (percent of ration dry matter): 1. control (pens 1 and 2) 61.9 percent corn silage, 32.3 percent high moisture corn (HMC), 5.8 percent soybean meal; 2. (pens 3 and 4) 69.5 percent ECW, 30.5 percent HMC; 3. (pen 5) 100 percent ECW; 4. (pen 6) 60 percent HMC, 40 percent ECW. Respective mean values for the four treatments during Period I (56 days on feed) were: average daily dry matter intake (kg) - 6.37, 6.83, 6.28, 7.06; feed efficiency (kg feed/kg gain) - 4.68, 5.61, 8.35, 5.64; average daily gain (kg) - 1.36, 1.22, .75, 1.29. In Trial II, four wether sheep were used per treatment in a three-phase metabolism trial. Treatments were (percent of ration dry matter): (1) 41.4 percent corn silage, 54.3 percent HMC, 4.6 percent soybean meal; (2) 50 percent ECW, 50 percent HMC; (3) 100 percent ECW; (4) 60 percent ECW, 40 percent HMC; (5) 100 percent corn silage; (6) 86.4 percent corn silage, 13.6 percent soybean meal. Respective mean values for dry matter intake (g) during the *ad libitum* phase and digestible dry matter (percent) were: (1) 1234, 78.0; (2) 1246, 66.9; (3) 1125, 47.2; (4) 1236, 61.4; (5) 903, 68.6; (6) 1129, 73.8. (Copyright 1976 - Journal of Animal Science) (Abstract only)

4390-A8, B2, E2

EFFECTS OF HEAVY FEEDLOT MANURE APPLICATION RATES ON THE BASIC INFILTRATION RATE OF SOIL

R. D. Stritzke
Unpublished Master's Thesis, Kansas State University, Manhattan, Kansas, 1973, 82 p. 9 fig., 14 tab., 24 ref.

Keywords: Land application, Manure, Irrigation, Application rates, Infiltration rates.

Manure applications were applied to test plots in the falls of 1969, 1970, and 1971. The desired manure applications were 0, 10, 20, 40, 80, 160, and 320 tons per acre per year. Other treatment plots received one year applications of 80, 160, and 320 tons per acre in the fall of 1969. These first year application plots did not receive any additional manure applications. The test plots were irrigated with a gated pipe and furrow irrigation system. The inflow-outflow method was used to determine the infiltration rate for each plot. The effects of heavy manure application rates on the basic infiltration rates of the test plots were evaluated. To accomplish this purpose, equations were developed using manure applications as independent variables to predict the soil's infiltration rate. The irrigation data indicated that heavy manure applications did affect the soil's basic infiltration rate. From the irrigation data analyzed, it was concluded that the greater the manure application, the greater the decrease in infiltration rates. Analyses also established that if manure was applied only one year after the initial decrease in the infiltration rate, the infiltration rate would increase with elapsed time from the application. When several year's applications had accumulated on the cropland, the most recent application had the most influence on the infiltration rate. (Merryman-East Central)

4391-A11, C1, C2

GASTROINTESTINAL TRACT pH AND STARCH IN FECES OF RUMINANTS

United States Department of Agriculture, Agricultural Research Service, Nutrition Institute, Ruminant Nutrition Laboratory, Beltsville, Maryland 20705
W. E. Wheeler and C. H. Noller
Journal of Animal Science, V. 44, No. 1, p. 131-135, Jan., 1977. 1 tab., 21 ref.

Keywords: Diets, Intestinal pH, Starch digestion, Fecal starch, Dietary buffers, Sheep, Cattle.

Three trials were conducted to study the relationship between pH in the gastrointestinal tract, fecal pH and starch in the feces of ruminants fed high energy diets. In all trials, fecal pH values were similar ($P > .10$) to those obtained for ingesta taken from the small intestine and colon, but higher ($P < .01$) than values obtained from the abomasum. Cattle and sheep fed non-buffered all-concentrate diets had intestinal pH values which were considerably lower than the 6.9 necessary for optimal activity of pancreatie alpha amylase. Low fecal pH was associated with large amounts of starch in feces of cattle fed high concentrate rations. The correlation coefficients relating fecal pH to starch in feces were -.82 and -.94 ($P < .01$), respectively, for the two cattle trials. Addition of limestone or magnesium limestone to high energy diets fed to cattle increased ($P < .01$) intestinal pH approximately 1.0 pH unit and decreased ($p < .01$) starch in feces from about 32 percent to 9 percent due presumably to a more favorable pH for pancreatic alpha amylase activity in the lower gastrointestinal tract. (Copyright 1977-Journal of Animal Science)

4392-A3, A4, A5, A12

NITRATES IN THE UPPER SANTA ANA RIVER BASIN IN RELATION TO GROUNDWATER POLLUTION

Extension Soil and Water Specialist, University of California, Davis, California
R. S. Ayers and R. L. Branson, editors
Bulletin 861, California Agricultural Experiment Station, 1973, 59 p. 30 fig., 20 tab., 112 ref.

Keywords: Santa Ana River Basin, California, Groundwater pollution, Nitrates, Public health, Pollutants, Fertilizers, Manure, Water pollution, Agricultural runoff, Leaching.

The extensive groundwater supplies in the Santa Ana Basin constitute a valuable resource which must be protected from excessive degradation if long-term beneficial use is to be realized. Nitrate in some of the Basin's well waters is already in excess of drinking-water standards of the U.S. Public Health Service. At the request of the Santa Ana Watershed Planning Agency (SAWPA), the Kearny Foundation of the University of California made a 3-month study of the nitrate problem in the Basin. The study was restricted for the most part to the Upper Basin (above Prado Dam), where preliminary work indicated that nitrate degradation of waters was most serious. A multidisciplinary approach was used for analyzing problem areas of high nitrate concentrations in the groundwaters, determining the probable cause of each problem area (agricultural fertilizers, manure disposal, waste-water disposal, etc.), and developing recommendations for prevention of future problems of a similar nature in the watershed. University staff (from the Experiment Station and Agricultural Extension) involved in this study represented the fields of surface and groundwater hydrology, soil and water chemistry, soil microbiology, sanitary and agricultural engineering, water science, and plant science. Special objectives included: a review of available data in order to identify and quantify existing high nitrate concentrations in groundwater; a review of the history of land and water use, waste disposal, and other practices in each problem area to form judgements on causes of high nitrate concentations, development of guidelines for rates of fertilization, water application, and animal waste disposal which will appreciably reduce the potential for nitrogen pollution of surface and groundwaters of the Basin consistent with reasonable levels of agricultural production; identification of areas of potential pollution related to nitrogen but not of primary concern in this study; and last but not least, identification of problems needing further study. (Ayers-University of California)

4393-A2, A6, B2, B3, B4, D2, D3, E1, E2, F1

AN ANALYSIS OF BEEF CATTLE FEEDLOT DESIGNS FOR POLLUTION CONTROL

Agricultural Engineering Research Division, Agricultural Research Service, Lincoln, Nebraska
C. B. Gilbertson
ARS 42-201, Agricultural Research Service, Lincoln, Nebraska, Aug., 1972, 8 p. 2 tab., 6 ref.

Keywords: Feedlots, Design, Cattle, Pollution control, Odor, Manure pack, Costs, Oxidation ditch, Runoff control, Land spreading, Waste storage, Incineration, Composting.

(1) The management schemes available to the feedlot operator are unpaved, paved, and housed feedlots. (2) Odor problems will limit outdoor commercial feedlot development as a management scheme in populated or recreation areas. (3) High labor requirements for manure management and apparent cattle discomfort may limit development of outdoor paved lots. (4) Housed feeding will become more popular with beef producers as labor shortages and pollution problems increase. (5) High labor and high bedding costs retard the potential development of feedlots using the manure-pack management scheme. (6) There is little difference between the overall materials cost of paved and unpaved feedlots. (7) For a housed feeding unit, the cost of the structure is about 50 percent of the total materials costs. (8) Use of an oxidation ditch with a housed feedlot increases the initial materials cost by about 17-20 percent. Annual electricity costs for operating the oxidation wheel will be approximately $1,750 per 100 head of capacity. (Gilbertson-Agricultural Research Service

4394-A8, B2, B3, B5, C2, E2

A FOUR-YEAR FIELD TRIAL WITH ANIMAL MANURES. I. NITROGEN BALANCES AND YIELDS. II. MINERALIZATION OF NITROGEN

Department of Soil Science and Agricultural Engineering, University of California, Riverside, California
P. F. Pratt, S. Davis, and R. G. Sharpless
Hilgardia, V. 44, No. 5, p. 99-125, Dec., 1976. 7 fig., 3 tab., 9 ref.

Keywords: Solid wastes, Liquid wastes, Dairy wastes, Feedlot wastes, Irrigation, Nitrogen, Land application, Application rates, Sudan grass, Barley, Volatilization, Mineralization.

Data are presented for a 4-year field experiment with various rates of both dry and liquid manures, and two levels of irrigation. Yields of sudangrass and barley forages were increased at moderate rates of manures, but higher rates decreased yields. Effects of the rate of irrigation water on yields were not significant. Leaching of NO_3^- was correlated with rates of manures applied. Increased drainage volumes decreased NO_3^- concentrations of leachate only at the high rates of manures, but increased mass emissions of NO_3^- for all manure treatments. A N balance in which the sum of accumulation in the organic matter, in crop removal, and in leaching losses was subtracted from the total N input in manure and irrigation water to obtain unmeasured losses, indicated that volatilization losses were small unless large excesses of manure were applied. The measured mineralization of the N added in dry dairy manure and in liquid feedlot manure agreed well with mineralization calculated from decay series. The relationships between forage yields and amounts of N leached as NO_3^-, and between yields and calculated rates of N mineralization were studied. The N in the dry dairy manure, which averaged 1.6 percent N on a dry weight basis, was about 45 percent available the first year after application, whereas the N in the liquid feedlot manure, which averaged 4.5 percent N on a dry weight basis, was about 75 percent available. The problems of conducting experiments with animal manures as N sources, and the implications of calculated mineralization rates, are discussed. (Pratt-University of California)

4395-A3, A4, A9

A MODEL FOR RUNOFF OF PESTICIDES FROM SMALL UPLAND WATERSHEDS

Supervisory Soil Scientist, U. S. Department of Agriculture, Watkinsville, Georgia
R. R. Bruce, L. A. Harper, R. A. Leonard, W. M. Snyder, and A. W. Thomas
Journal of Environmental Quality, V. 4, No. 4, p. 541-548, Oct.-Dec., 1975. 8 fig., 1 tab., 18 ref.

Keywords: Model studies, Agricultural runoff, Erosion, Sediment, Pesticides, Rainfall-runoff relationships, Water quality, Water pollution.

A mathematical model was developed which describes the rate and quantity of runoff water from separate rainfall events on a watershed and the rate and quantity of sediment and pesticides transported. The experimental site used in the model testing was a 2.71-ha watershed in the upper Piedmont plain near Watkinsville, Georgia. Instruments were installed to measure rainfall and surface runoff in addition to providing runoff samples for sediment and chemical analysis. The watershed was planted to soybeans with rows roughly perpendicular to the main drainage channel. Trifluralin was applied before planting at a rate of 1.12 kg/ha and incorporated to a depth of approximately 7.5 cm. Diphenamid at 3.36 kg/ha, and paraquat at 11.2 kg/ha, were surface-applied at a rate 20 times the normal rate for weed control to serve as a tracer for strongly adsorbed chemicals. The model was tested for 4 storms which occurred during summers 1972 and 1973. These storms were short duration and were characterized by relatively high intensities where most of the rain fell in 10 minutes or less. The model adequately simulated the runoff of paraquat, trifluralin, and diphenamid during the runoff events. However, the model's current capability, extensibility, and utility should be put in perspective. Another version of the current model is contemplated to simulate runoff of mobile chemicals, like NO_3^- of $C1^-$. A vital component of this model must be subsurface water transport. The current model provides a concentual base for extension and refinement to include runoff of mobile chemicals. (Rowe-East Central)

4396-A6, B2, B4, C2, D1, D3

WINTER OPERATION OF AERATED LIQUID ANIMAL WASTE STORAGE SYSTEMS

School of Engineering, University of Guelph, Guelph, Ontario
J. Poe and J. B. Robinson
Canadian Agricultural Engineering, V. 15, No. 1, p. 43-48, June, 1973. 2 fig., 12 tab., 8 ref.

Keywords: Waste storage, Aeration. Odor control, Poultry wastes, Duck wastes, Liquid wastes, Model studies, Field studies, Oxidation ditch, Chemical properties, Mechanical aeration, Pneumatic aeration.

The research from which this report was prepared was concerned primarily with mechanical aeration and to some extent pneumatic aeration. The major objective is to provide long-term storage with minimum odor. Preliminary investigations dealing with mechanical aeration were conducted on pilot-scale oxidation ditches using liquid poultry manure. These investigations were followed by field studies using an outdoor oxidation ditch on a commercial hog operation, and a surface aerator using liquid hog manure. A similar approach was taken for the pneumatic aeration systems. Pilot studies were conducted on a simple air diffuser and this was followed by field studies on the waste handling system of a large commercial duck farm. Another pneumatic aeration system was installed in an outdoor oxidation ditch for liquid hog manure. The results of these investigations have shown that obnoxious odors can be controlled by mechanical and pneumatic aeration systems. However, the mechanical rotor and surface aerator will require some special protection in outdoor storage systems at freezing temperatures. (Copyright 1973 - Canadian Agricultural Engineering)

4397-B2, C2, D3, E2

TREATMENT SYSTEMS FOR ANIMAL, AGRICULTURAL AND MUNICIPAL WASTES

Department of Biological and Agricultural Engineering, North Carolina State University
F. J. Humenik
Proceedings of Workshop on Land Disposal of Wastewaters, Nov. 20, 1973, Raleigh, North Carolina: North Carolina University Water Resources Research Institute Report 91, p. 91-103, 1973. 1 fig., 5 tab.

Keywords: Biological treatment, Animal wastes, Agricultural wastes, Municipal wastes, Aerobic treatment, Anaerobic treatnent, Lagoons, Ponds, Land applications, Nitrogen.

The classic sewage stabilization lagoon or anaerobic pond for animal waste treatment is one of the most simple units for waste degradation. Increased degrees of treatment can be obtained if aeration is employed to help satisfy the oxygen demand and control odor. Lagoons can be placed in series to allow alternative anaerobic-aerobic treatment strategies. For example, nitrification-denitrification can be facilitated when aeration is employed in the first unit, and the second unit is maintained anaerobic by direct raw waste inputs. Pond systems can also be helpful in removing heavy metals if organic waste input is high and the organic metal complex remains in the bottom sludge. Pond systems may not, however, be considered as terminal treatment devices in which excess water can be discharged to surface streams. Rather, pond systems are pretreatment devices that may be used prior to terminal land irrigation of excess liquid. While it is recommended that loading rates for animal waste lagoon liquid application to land be based on the nitrogen requirements for each particular vegetative cover, thought should also be given to balancing both the amount of liquid and the amount of nitrogen applied so that both hydraulic and process load are taken into consideration. Consideration should be given to using anaerobic ponds because of the high loading rate that can be imposed upon these relatively simple devices with the application of the excess liquid to cropland. This type of system is economical, imposes very little health or pollutional hazards, and emphasizes utilization of the waste nutrients. Consequently, many of the systems being developed for agricultural waste management may also have great applicability for treatment of municipal, processing, and industrial wastes as emphasis on waste utilization becomes more directive. (Bates-East Central)

4398-B2, B4, C2, E3

ANNUAL DYNAMICS OF CHANGES IN CHARACTERISTIC PROPERTIES OF CATTLE LIQUID MANURE FROM LITTERLESS OPERATIONS

Institute of Plant Nutrition, Research Institutes for Crop Production, Praha-Ruzyne, Czechoslavakia
S. Bonischova-Franklova and B. Novak
Rostlinna Vyroba, V. 22, No. 8, p. 827-834, 1976. 13 fig., 3 tab., 26 ref.

Keywords: Cattle manure, Liquid wastes, Czechoslovakia, Microorganisms, Organic matter, Micromycetes, Waste storage, Anaerobic conditions, Recycling.

The dry matter content of cattle liquid manure samples from litterless houses varies in the course of the year considerably, the organic matter content of the dry matter, however, remains unchanged. The amount of C_{ox} is in correlation with that of organic substances. The biochemical activities and counts of microorganisms, particularly of bacteria growing on meat-peptone-agar and on starch-agar in aerobic conditions and of micromycetes growing on Jensen's agar depend considerably on the season of the year. The number of anaerobes in the samples of cattle liquid manure increases both absolutely and relatively, evidently due to anaerobic conditions of liquid manure storage. These properties are of importance for agronomic utilization of cattle liquid manure as a fertilizer. (Copyright 1976-Rostlinna Vyroba)

4399-A11, B3, E3

UTILIZATION OF CATTLE EXCREMENT FOR GROWTH AND MAINTENANCE OF BEEF CATTLE

Texas A&M University, College Station, Texas 77843
L. M. Schake, B. W. Pinkerton, C. E. Donnell, J. K. Riggs and R. E. Lichtenwalner
Journal of Animal Science, V. 45, No. 1, p. 166-179, July, 1977. 1 fig., 9 tab., 28 ref.

Keywords: Refeeding, Cattle manure, Performance.

Excrement produced by cattle fed high energy diets was studied in the unaltered and high fiber forms as a reconstitution media and as a feed ingredient in feeding and digestion experiments with cattle. Excrement was found to be slightly more effective than water as a reconstitution media for sorghum grain if excrement to grain ratios did not exceed 1:1.6 (w/w). Grain dry matter required per kg of steer gain for water and excrement reconstitution grain was 10.6 percent and 12.6 percent less ($P < .10$), respectively, than controls. Steers fed excrement reconstituted grain had higher dressing percentages ($P < .10$), and their carcasses tended to contain more fat than controls. Crude protein digestibility of excrement and water reconstituted grain was improved 9.2 percent ($P < .10$) over dry grain. Particle size of all reconstituted grains was smaller ($P < .05$) than for dry grain. Normal reconstitution was observed with a 1:2.5 high fiber excrement to grain ratio (w/w). High fiber excrement was identified as a useful feed ingredient for mature cows. Cow weight gains in excess of 1 kg per day were observed with feed mixtures containing from 18 to 50 percent high fiber excrement dry matter. Body weight maintenance was achieved for cows when 68.6 percent of their feed dry matter intake was high fiber excrement. (Copyright 1977-Journal of Animal Science)

4400-A11, B3, C2, E3

RECYCLING ANIMAL WASTES

Poultry Science Department, Michigan State University
H. C. Zindel
Nutrition Symposium on Proteins, Iowa State University, June 7-8, 1972, 12 p., 7 tab., 8 ref.

Keywords: Refeeding, Dried poultry wastes, Crude proteins, Performance, Poultry, Cattle, Eggs, Milk, Taste.

The development of dried poultry waste as a feed is outlined. Dried poultry waste (DPW) is a product that is heat-processed in a dehydrator at temperatures which range from 80° C to 50° C, depending upon the desired temperature. In one study, a 4.5 pound hen which produced 350 eggs and which utilized only 4-5 pounds of 15-17 percent protein feed to produce a dozen eggs was found to avoid excreta which contained 10.25 percent usable protein. A number of other DPW refeeding experiments have been conducted. The crude protein of DPW from birds fed 12.5 percent DPW in their rations ranged from 19.9 to 39.5 percent on a moisture-free basis. Egg production of birds fed the diet which contained 12.5 percent DPW was slightly higher than egg production of birds fed 2 other diets. Feed efficiency closely paralleled egg production. Highest rate of mortality was among the control birds. Another trial utilizing a control ration and rations containing 10, 20, and 30 percent DPW revealed that two-thirds of the time taste panel members preferred the taste of eggs from birds fed DPW over the taste of eggs laid by birds fed standard diets. In another test, milk samples from 7 cows fed DPW and milk samples from cows fed other rations were scored for flavor. The flavor of milk produced by cows fed DPW was found normal. When carcass evaluations were made between beef cattle fed DPW and cattle fed other rations, no significant differences were observed. These studies reveal the potential in the refeeding of DPW as a source of protein. (Rowe-East Central)

4401-A4, A11, B2, C1, C2, C3, D1

CHARACTERIZATION AND TREATMENT OF WASTE DISCHARGED FROM HIGH DENSITY CATFISH CULTURES

Water Quality and Ecology Branch, Division of Environmental Planning, Tennessee Valley Authority, Chattanooga, Tennessee 37401
R. J. Ruane, T. J. Chu, and V. E. Vandergriff
Proceedings of the 30th Industrial Waste Conference, Purdue University, May 6, 7 & 8, 1975, p. 1043-1065. 18 fig., 6 tab., 16 ref.

Keywords: Fish farming, Catfish, Water pollution, Sedimentation, Fecal coliforms, Organic compounds, Ammonia Nitrogen, Phosphorus, Settleable solids, Suspended solids, Effluents, Environmental Protection Agency.

Organic compounds, solids, ammonia nitrogen, and phosphorus are the main pollutants from high-density channel catfish raceways. The organic compounds and total phosphate are related to concentrations of solids. Concentrations of ammonia nitrogen and dissolved oxygen can be used as measures of metabolic activity. It appears that it might be more desirable to feed the catfish at least twice rather than once daily. The results of the 1974 studies indicate that only concentrations of settleable solids and fecal coliform bacteria exceed the proposed EPA guidelines for effluent limitations and therefore, will require some means for removal. However, if the feeding rate had been greater, the proposed EPA limits on ammonia nitrogen and suspended solids might also have been exceeded. The waste characteristics of raceway discharges varied considerably with activity (i.e. metabolic, feeding, and flushing). However, with respect of daily mass loads of pollutants, the metabolic and feeding periods contribute essentially all the wasteload. Monitoring of raceway effluents should consist of 24-hour composited samples to "average" the effects of the various activity periods. Also, such samples should be collected during "normal" days for the variables that affect wastewater characteristics (i.e. dissolved oxygen concentration, feeding rate, flow rate, and type of feed used (sinking vs. floating). Variables affecting waste characteristics include dissolved oxygen concentration, temperature, size of fish, feeding rate, stocking density, water flow, type of food, and activity period. Simple sedimentation of raceway effluents for a detention time of 15 minutes can remove more than 76 percent of the settleable solids. The effluent from such a settling facility contains less settleable solids than the effluent limitations proposed by EPA. Suspended solids, organic compounds and total phosphate are removed in the settling basin to a lesser extent. Removal of these pollutants is greater during the flushing period because a larger percentage is associated with the suspended solids. Further study is needed to determine: (1) the source of the fecal coliform bacteria in raceway culture; (2) the effects of temperature, feeding rate, stocking density, and other variables on generation of fecal coliform bacteria; and (3) methods to reduce generation of the fecal coliform bacteria or to economically disinfect the raceway discharge. (Copyright 1975 - Purdue University)

4402-B2, E2

RALPH KISSINGER, JR. -- 1977 FARMER-FEEDER OF THE YEAR

Staff editor, Feedlot Management
G. Lamp
Feedlot Management, V. 19, No. 3, p. 10-14, 18, March, 1977. 7 fig.

Keywords: Management, Cattle, Confinement pens, Flushing, Slatted floors, Liquid wastes, Land disposal

In 1971, a pre-production model called a slope-slat, flush barn was designed by Ralph Kissinger. The building is flushed daily from both ends toward the center and out to a 1½ million gallon lagoon. Two flushing pits run the entire length of the 510 ft. building. The 52 ft. width includes a front feeding alley and six separate pens that allow cattle 8.3 sq. ft. per 1,000 lb. of body weight. A major reason Ralph went with confinement was to utilize liquid wastes for cropland. Of Kissinger's 649-head cow herd, 383 are Tarentaise and the other 266 are either Jersey-Angus or Hereford-Angus crosses. It is felt that these crossbreds have some favorable feedlot qualities such as: (1) improved yield and cutability, tenderness and taste, (2) consistently better yield, and (3) light boned, excellent round without a thick fat covering. All cattle at the feedlot go through the confinement barn before market. For 10 days to 2 weeks, cattle start outside in open lots on a roughage ration. They are then fed ration numbers 2-5 for 10 days to 6 weeks. Once they reach the number 6 finishing ration, they're fed 2 weeks before moving to the confinement barn. Dipping for grubs and lice, worming with drench or paste, implanting first with DES and vaccinating for IBR, Lepto and 7-way Blackleg are regular procedures. Ralph has found most cattle from the confinement unit yield at least 1 percent better than cattle in outside lots. (Rowe-East Central)

4403-A8, A11, A12, B1, C3, D3, E2, F1, F4

RESEARCH AND DEVELOPMENT NEEDS RELATED TO PATHOGENS IN PRETREATMENT-LAND APPLICATION SYSTEM

North Carolina State University, Raleigh, North Carolina 27607
M. R. Overcash
Paper No. 76-2561, American Society of Agricultural Engineers, 1976 Winter Meeting, Chicago, Illinois, Dec. 14-17, 1976, 16 p. 5 fig., 7 ref.

Keywords: Research and development, Waste treatment, Pretreatment, Land application, Pathogenic bacteria, Viruses, Public health, Animal health, Sprinkler irrigation, Wind tunnels, Costs, Soil systems, Buffer zones.

Research and development needs related to the land application of wastes containing pathogens are presented as potential research areas for engineers. The "bottom line" of all studies concerning aerosolized pathogens must be that there is a cause and effect relationship between land application of municipal waste and the health of persons or animals under constant or transient exposure. Any relationship must be compared to this same cause and effect study for other wastewater practices because some alternative approach for waste management must be selected. As data from small scale studies of sprinklers, test plots, wind tunnels, etc. become available, there will arise a need for scale-up information. The comparative pathogen risk from a conventional treatment-stream discharge is needed on the long term implication of applied bacteria in the soil system. The balance between the costs of various control techniques and the costs of different levels of pathogen pretreatment must be evaluated. The concept of trade-offs which must be evaluated through research studies are: (1) the level of disinfection and the amount of buffer zone, (2) the types of pretreatment which produce a similar aerosolized effect at a given buffer distance, and (3) the alternative application systems versus the amount of buffer zone. (Merryman-East Central)

4404-B2, B3, C1, D1, E2, E3

CALIFORNIA DAIRYMEN ARE GAINING EXPERIENCE WITH MANURE SEPARATORS

G. Beall
Hoard's Dairyman, V. 122, No. 16, p. 964, 1001, Aug. 25, 1977. 3 fig.

Keywords: Waste management, Dairy wastes, Liquid wastes, Solid wastes, Separation techniques, Hydrasieve, Chain drag system, Shaker screen, Recycling, Flushing, Irrigation, Bedding, Soil amendments.

Three types of manure management systems that are being used in California dairies are presented. Adam Van Exel of Lodi, California has an industrial model hydrasieve which allows liquids to pass through a screen and return to a reservoir for later use as irrigation water or for recycling to his flush tanks, while the solids drop off the slanted hydrasieve screen onto a concrete pad in a moist--but not soggy--condition. The solids are removed periodically, spread for drying, and stockpiled for use as bedding. John Lima has a newer model hydrasieve that has an added feature -- a 50 ft. auger that squeezes excess moisture out of the solids after they come off the screen and builds up a long pile of solids, thus eliminating frequent removal. Lima has had problems with liquid overflow into his pile of solids. Lima blames improper design, but the company contends that Lima is not flushing his alleys often enough. The Burroughs Brothers near Oakley, California do their manure separating with a chain drag system. The principle of this system is that liquids and solids are separated in a setttling sump. A mechanical drag then removes settled solids from the bottom of the sump. The liquids are used for irrigation and flushing and the solids for bedding. George Mertens of Sonoma, California uses a shaker screen that operates on the same principle as the hydrasieve except that the screen vibrates; the screen is driven by a small motor. Three motors are needed at the separator -- one to drive the vibrator, one to pump wastes up to the separator and one to drive an agitator to keep solids from settling in the sump. The liquid portion is passed to 1 of 2 holding tanks for flushing or irrigation and solids are used for bedding and soil amendment. Because sand, rocks, long hay, and hair have caused pumping problems, Mertens is considering switching to a chain drag system. (Bates-East Central)

4405-A7, B2, B3, C2, D3, E2, E3, F1

A CLEAN NEW GAS

Department of Agricultural Chemistry and Soils, University of Arizona, Tucson, Arizona
H. L. Bohn
Environment, V. 13, No. 10, p. 4-8, Dec., 1971. 2 fig.

Keywords: Sewage, Urban wastes, Agricultural wastes, Recycling, Anaerobic digestion, Methane, Effluent, Sludge, Irrigation, Land disposal, Aerobic treatment, Costs, Air pollution.

Urban and agricultural wastes are potential sources of methane for fuel. Not only are these wastes renewable energy sources, their conversion into fuel reduces the problem of waste disposal. Maximizing the utility of such organic wastes can minimize the amount to be disposed of and the methane produced can partially or completely offset the costs of waste disposal. The technology of anaerobic digestion for production of methane is reasonably well worked out. Anaerobic digestion is virtually unavoidable in present-day sewers and sewage plants and is responsible for much of the unpleasant atmosphere around sewage plants. A mixture of organic solid waste and sewage would take advantage of the properties of both for methane production. Sewage is rich in nitrogen, phosphate, and other microbial nutrients. Solid wastes such as paper are rich in cellulosic carbon but poor in nutrients. A diagram illustrates how organic wastes and sewage could be digested in an anaerobic digestor with the resulting gases going through a gas scrubber, resulting in methane recovery. Remaining effluent would go through oxidative treatment and would be utilized as irrigation water. Remaining sludge would be disposed of on the land. (Merryman-East Central)

4406-A9, A10, B1, B4, C1, D2

CONTROLLING FLIES WITH IN-HOUSE MANURE STORAGE

Texas A&M University, College Station, Texas
F. D. Thornberry
Poultry Digest, V. 36, No. 426, p. 390, Aug., 1977.

Keywords: Fly control, Poultry wastes, In-house manure storage, Moisture content, Coning, Insecticides.

Ventilation and drying of poultry manure is extremely important when manure is stored beneath cages in open pits. Fly development normally decreases as moisture content of manure decreases with development, ceasing in the 28-30 percent range. Control of water leaks and seepage is also important. Coning of the wastes will increase surface area and aid in drying. Wet spots may be treated with lime for fly control. In enclosed housing, contact insecticides may be used as well. In open housing, continuous use of a contact insecticide and an effective larvicide is usually needed due to continuous invasion by flies from neighboring areas. (Merryman-East Central)

4407-A11, B2, C2, D3, E3

EFFECT OF CORN STOVER SILAGE DIETS SUPPLEMENTED WITH NITROGEN FROM POULTRY EXCRETA ON DRY MATTER INTAKE AND GROWTH OF YEARLING DAIRY HEIFERS

Animal Physiology and Genetics Institute, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland 20705
J. E. Keys and L. W. Smith
Dairy Science Handout P-108, Animal Physiology and Genetics Institute, Beltsville, Maryland, 6 p. 3 tab.

Diets, Dairy heifers, Caged laying hen excreta, Refeeding, Performance, Ensiling, Corn stover silage, Corn silage, Soybean meal protein.

A trial was conducted to determine the effects of corn stover silage diets supplemented with fresh caged laying hen excreta and of high moisture grain and cob on weight gains and intakes of yearling dairy heifers. Four silages of the following combinations were fed: (1) corn stover silage - 67.5 percent corn stover, 20.2 percent ground whole ear corn, and 12.3 percent fresh poultry excreta; (2) corn stover silage - 52.7 percent corn stover, 38 percent ground whole ear corn, and 9.3 percent fresh poultry manure; (3) whole plant corn silage - 90 percent whole plant corn and 10 percent fresh poultry excreta; and (4) whole plant corn silage - 95.2 percent whole plant corn and 4.8 percent soybean meal protein. Seven yearling Holstein heifers were individually fed each of the 4 silages by use of individual electronic feedgates for 4 consecutive 45-day periods. Individual feed intakes and weight gains were recorded. The heifers were group housed in a 30 free-stall, 3-sided shed. Corn stover silage intakes were lower than the corn silage intakes, probably as a result of the larger particle size and spoilage development. Corn silage with poultry excreta did ot support gains as well as the soybean meal corn silage, probably due to lower digestibility of the poultry excreta protein. Treatment effects on average daily gains were not significant. Digestion trial studies were conducted with the 4 silages, but the analyses have not been completed to date. It was concluded that intakes of corn stover silage by heifers will have to be increased if body weight gains are to be improved. Before the stover is ensiled, it should be chopped to a particle size similar to that of corn silage if the stover is to be packed tightly in the silo to exclude air and reduce mold and spoilage development. (Merryman-East Central)

4408-A11, B5, C2, E2
FORAGE CROPS. GRASS TETANY.

G. C. Marten
1975 McGraw-Hill Yearbook of Science and Technology. McGraw-Hill Book Company, New York, New York, 1975, p. 206-207. 2 fig.

Keywords: Grass tetany, Animal health, Cattle, Ruminants, Magnesium deficiency, Dietary magnesium, Forages, Grasses, Legumes, Poultry manure, Poultry litter, Fertilizers.

Grass tetany, a magnesium (Mg) deficiency in cattle and other ruminants has caused many livestock deaths in the United States and throughout the world. Occurrence of grass tetany depends greatly on forage constituents that reduce the availability of dietary Mg. When cattle graze forage containing less than 0.2 percent Mg, grass tetany may occur. Forage Mg levels vary because of cultural practices that affect the actual amount of soluble Mg in the soil or its availability to plants. For example, fertilizing with high levels of potassium often depresses Mg uptake by plants. Organic manuring also may affect forage Mg concentraitons. For example, applying large amounts of animal litter may increase the tetany hazard. There are several management alternatives that may be used to reduce grass tetany. Pastures can be renovated to include a larger proportion of legume. Forage may be dusted with 30 kg/ha MgO or sprayed with Mg-bentonite clay-water slurry. Magnesium fertilization will increase the Mg concentration of forage grown on coarse-textured acid soils. Another helpful practice is to apply only a portion of the N and K fertilizer in early spring and apply the remainder later in the season. Grazing of forage likely to produce tetany should be postponed or should be grazed by livestock having lower Mg requirements, such as non-lactating animals. The most direct method of reducing Mg tetany is to supplement the animals' diets with Mg. (Merryman-East Central)

4409-B2, B5, E2, F1
THE NEED FOR INTENSIFICATION IN ANIMAL PRODUCTION AND THE CONSEQUENT POLLUTION PROBLEM

BOCM Silcock Ltd, Basing View, Basingstoke, Hants, England
P. N. Wilson
Journal of the Science of Food and Agriculture, V. 23, No. 12, p. 1393-1398, Dec., 1972. 2 tab., 3 ref.

Keywords: Animal production, Feedlots, Confinement pens, Waste management, Land disposal, Economics, Great Britain, Effluent disposal plants.

Degree of intensification in animal production should be based on a determination of how near to the "biological ceiling" of animal output different systems of animal production are likely to progress, and second, what particular rate of return on input investment is demanded from the enterprise. The following predictions may be made for Great Britain in terms of probable future systems of animal production: (1) Britain will have achieved full entry into EEC by 1975 with consequent effect on its overall agricultural pattern. (2) The real costs of labor (including direct and indirect costs) will continue to rise, and by 1975 the real minimum agricultural wage will be about 2000 pounds/annum. (3) The substitution of levies for subsidies will give greater inducement to the efficient producer and less inducement for the continuation of current unproductive and extensive agricultural practices. (4) Land values will continue to rise. Prices in the amount of 500 pounds/acre are likely to be common by 1975. The effect of this will be that a 10 percent return on land valued at this figure will require 50 pounds/annum/acre to service it. (5) The value of breeding animals will continue to rise and the differential between top quality and medium quality breeding stock will widen. Changes in management practices for broilers, laying hens, swine, sheep, cattle, and dairy cattle are considered and the genetic, managerial and economic constraints are briefly discussed. Manure production rates and amount of land required for manure disposal for each of these animals is outlined for various management systems. The decision must be made as to whether it is possible to run intensive animal units completely divorced from the land, with the consequence that expensive effluent plants would have to be built and serviced, or whether it is in the best interests of British agriculture, and of the nation as a whole, to wed intensive animal enterprise to land in such a way that stocking rates and disposal areas correspond to each other. British agriculture, as presently financed, would be unable to find the large capital sums either for sewage disposal plants or for "effluent disposal acres" out of the current level of profitability of animal production. Some form of assistance would be needed. (Merryman-East Central)

4410-A11, B3, C2, E3, F1
POULTRY WASTE -- NITROGEN FOR LACTATING DAIRY COWS

Anonymous
Hoard's Dairyman, V. 122, No. 16, p. 962, Aug. 25, 1977.

Keywords: Refeeding, Dried poultry excreta, Performance, Nitrogen, Diets, Feed consumption, Milk production, Economics.

Poultry wastes may one day be used as a source of dietary nitrogen for lactating dairy cattle, says Dr. C. C. Calvert, an animal scientist with USDA's Agricultural Research Service. In tests at the Beltsville Agricultural Research Center in Maryland, groups of 6 Holstein cows were fed one of four diets. All 4 diets consisted of a corn-soybean meal concentrate supplemented with one of the following: (1) 2 percent urea, (2) 17.2 percent dried poultry excreta (DPE), (3) 26 percent DPE, (4) additional soybean meal. Cows on all 4 diets consumed about the same amount of feed. However, those on the 17.2 percent DPE diet produced 8 percent more milk than those cows on the urea supplemented diet and about 7 percent more milk than those on the 26 percent DPE or soybean meal diets. Based on cost of concentrate/kilogram of milk produced, the DPE diets were about 11 percent less expensive than either of the other 2 supplemented diets. (Bates-East Central)

4411-B3, C1, D1, E3, F1
WAYS TO SPEED UP DRYING OF MANURE IN PITS

Extension Poultry Specialist, Pennsylvania State University, University Park, Pennsylvania
H. C. Jordan
Poultry Digest, V. 36, No. 426, p. 375, Aug., 1977.

Keywords: Poultry wastes, Drying, Ventilation, Fans, Stirring, Pits, Moisture content, Recycling, Fertilizers, Refeeding, Economics, Pennsylvania.

According to Herbert C. Jordan, Extension Poultry Specialist, Pennsylvania State University, there are 4 ways to speed up manure drying in pits. They are: (1) Have several high velocity fans installed 2 feet above the concrete pit floor, all flowing in the same direction. (2) Stir the manure every hour with a rake with blades on it which will move the manure 1 to 2 feet sideways across the pit into a window as the rake passes by. (3) Use plastic plenum along the ceiling with a large centrifugal fan blowing air into the house and down over the birds. The air, which is warmer as it enters the pit, is then swept over the manure and out of an electrically controlled louver at the end of the building. (4) The manure can be dried by this method down to 25-30 percent moisture in 2 days. Drying manure from 75 percent moisture to 25 percent moisture within 2 days, inside the house, improves its fertilizer as well as its feed value. This material is selling from $40/ton up to $100/ton in Pennsylvania. (Bates-East Central)

4412-A2, A11, B1, B3, C2, E2
SALT LEVELS IN STEER FINISHING RATIONS

Texas Tech University Center at Amarillo, Pantex, Texas 79069
R. L. Kellison, R. H. Klett, L. B. Sherrod, and R. C. Albin
Research Report No. 24, Texas Tech University Center at Amarillo, Pantex, Texas, March, 1974, p. 73-77.

Keywords: Cattle, Feeds, Salt levels, Performance, Cattle wastes, Coring studies, Feedlots, Agricultural runoff, Land application.

A steer finishing trial was conducted to relate sodium levels in beef cattle finishing rations to animal performance and concentration in feedlot solid-waste. One hundred steers were allotted into four treatment groups with five replications of five steers each and fed rations containing 0.0, 0.5, 1.0 percent and free choice salt. Animal performance was measured by 28 day weights, feed consumption, efficiency of feed utilization and carcass measurements. Sodium (Na) concentration and build-up in the solid-waste was measured at 28 day intervals by sampling the feedlot with a coring device. Sodium concentration in the rations was not significantly related to average daily gain, feed intake or carcass traits. Sodium intake per day for treatments 1 through 4 was 16.0, 29.0, 48.5 and 66.0 grams per head daily and was not related to ration consumption. There was a linear relationship between sodium intake and sodium concentration in the solid-waste. Levels of sodium accumulation in the solid-waste appeared to be sufficiently low so as not to be harmful in run-off or to crop lands if applied at 10-15 tons per acre every 3-4 years. (Kellison-Texas Tech University Center at Amarillo)

4413-A2, A4, B1, C1, C2, D1, F1, F2

PREVENTING POLLUTION WHILE EXPANDING THE LIVESTOCK INDUSTRY IN SOUTH DAKOTA

Department of Agricultural Engineering, South Dakota State University, Brookings, South Dakota
J. N. Dornbush and J. M. Madden
Symposium Proceedings: South Dakota's Environment - Its Pollution and Preservation, South Dakota State University, April 13, 1971, p. 15-19. 4 fig., 3 tab.

Keywords: Feedlots, South Dakota, Livestock, Water pollution, Management, Cost sharing, Regulation, Agricultural runoff, Climate, Pollution control, Consolidation, Location, Diversion, Terraces, Debris basins, Detention ponds.

A great deal has been learned in the past several years concerning the magnitude and control of pollution from feedlots. It appears that the overall pollution problem from livestock feeding operations may not be as critical in South Dakota as has been assumed in other areas. Climatic factors appear favorable; nevertheless, feedlots poorly located with excessive drainage may be expected to cause serious pollution, especially to lakes. Information and assistance is presently available to plan the construction of practical, economical pollution control facilities, and cost-sharing for the construction is available. There now appears to be little excuse for delaying a program to prevent pollution with all planned construction for expansion of the feeding industry. (Dornbush - South Dakota State University)

4414-A11, B2, C3, D3

BACTERIOLOGICAL STUDIES OF CONFINEMENT ANIMAL WASTE AND SURVIVAL STUDIES OF INDICATOR BACTERIA IN ANIMAL WASTE

F. T. Coles
M. S. Thesis, North Dakota State University of Agriculture and Applied Science, Fargo, North Dakota, 1973, 50 p. 8 fig., 4 tab., 57 ref.

Keywords: Bacteria, Cattle wastes, Swine wastes, Confinement housing, Anaerobic lagoons, Aerobic lagoons.

This study was undertaken in an effort to answer the following questions: (1) Are cattle kept in confinement housing subjected to stress which might be evidenced in differences or changes in their normal intestinal bacterial flora? (2) What bacteria are present in manure from normal, healthy cattle? (3) How long will fecal indicator organisms and *Salmonella* organisms survive in anaerobic and aerobic animal waste lagoons? In part I of the experiment, housing for experimental animals was of 3 different types: (1) Confinement housing on a slatted floor over a shallow sloped pit from which solid wastes were scraped daily. Liquid wastes were collected in a holding tank and pumped to a disposal lagoon. Air passed into and out of the building over a rock bed heat sink which helped to maintain warmer temperatures during cold weather. (2) Confinement housing on a slatted floor over an 8-ft-deep waste storage pit cleaned yearly. Air circulation was controlled by a thermostatically-regulated fan. (3) Non-confinement housing in which the animals had free access to an outside area. This group was set up as an unconfined control. Part II of the study was concerned with the analysis of 2 animal waste lagoons located near the Animal Research Center of North Dakota State University. One was an aerobic lagoon which received liquid wastes from the floor of a cattle confinement barn. The other was an anaerobic lagoon which received liquid wastes from hog and cattle barns with some human wastes. The normal intestinal bacterial flora of the 38 steers involved in this study averaged a total aerobic count of 8 x 10 /g with fecal coliforms outnumbering fecal streptococci by a ratio of 300:1. No pathogenic organisms were recovered. No significant difference was found between bacterial populations in manure from steers kept in 2 different types of confinement housing and corresponding population determinations on an unconfined control group. Survival of indicator organisms in aerobic and anaerobic lagoon water indicated that, in general, both fecal streptococci and fecal coliform populations declined more rapidly under aerobic conditions. Under some conditions, fecal streptococci survived longer than fecal coliforms. Survival rates of both organisms were enhanced by anaerobic conditions and by maintainance in the cold. Salmonella survived for 20 days in water maintained at 7°C. (Merryman-East Central)

4415-A11, B1, D3

FIVE-YEAR BEEF ANIMAL ENVIRONMENT STUDY IN MINNESOTA

USDA-ARS-NCR, University of Minnesota, Minneapolis, Minnesota 55455
R. O. Hegg, R. E. Larson, J. A. Moore, J. C. Meiske, and R. O. Goodrich
Proceedings of the International Livestock of Environmental Symposium of the American Society of Agricultural Engineers, p. 316-323, 1974. 4 fig., 4 tab.

Keywords: Confinement pens, Open lots, Minnesota, Cattle, Performance, Economics, Oxidation ditch.

Many factors must be considered when deciding whether to feed cattle in confinement or in an open lot, including: available labor, potential pollutional problems, available land, and capital expenditure. This paper indicates that warm confinement feeding and outside feeding are not significantly different in average daily gains for Herefords in Minnesota. The economic calculations showed that feed efficiency improved in the confinement pens just enough to offset the higher housing and operational costs. The solid concrete floor pen showed the highest return per steer of any of the systems. If the oxidation ditch system was not used, the cost of the confinement treatment would be slightly reduced, which would show a cost benefit from confined feeding over outside feeding. The economic calculations (table 4) are very dependent on the buying and selling price of the cattle and feed cost. The high cost of corn in the winter of 1974 makes the increased feed efficiency of the confinement fed cattle a very important factor. (Hegg-University of Minnesota)

4416-A11, B1

A STUDY ON ELIMINATIVE AND GRAZING BEHAVIOUR -- THE USE OF THE FIELD BY CAPTIVE HORSES

Rijksuniversiteit Gent, F.P.P.W., Ledeganckstraat 35, B-9000 Gent (Belgium)
F. O. Odberg and K. Francis-Smith
Equine Veterinary Journal, V. 8, No. 4, p. 147-149, Oct., 1976. 1 fig., 2 tab., 14 ref.

Keywords: Horses, Eliminative areas, Grazing areas.

Field observations show that adult trotting horses nearly always eliminate in special areas which are rarely grazed. Hence the division of the fields into areas of high grass (''eliminative areas'') and short grass (''nutritive areas''). A substantial surface is thus lost for grazing. This behavior seems less pronounced in foals. (Copyright 1976 - Equine Veterinary Journal)

4417-A9, A11, B1, D2, D3

AN EVALUATION OF FIELD STUDIES ON CONTROLLING THE HOUSE FLY, *MUSCA DOMESTICA*

Texas Agricultural Extension Service, Texas A & M University. College Station, Texas 77843
F D. Thornberry and C. L. Cole
Poultry Science, V. 56, No. 5, p. 1762, Sept., 1977.

Keywords: Fly control, Altosid, Sugar baits, Muscamone, Manure pits, Poultry.

Increasing environmental awareness dictates that a continuous search for more effective fly control methods for caged layer operations be maintained. Results of Extension field studies in Texas have proven beneficial in developing more effective control programs. Basic studies have shown larvae hatch counts exceeding 450 day-old larvae per eight cubic inches of manure from untreated manure pits. Fly development exceeding 350 flies per week per square foot of untreated manure were measured in pits beneath cages. A series of trials in which the juvenile hormone Altosid was fed on a continuous basis to more than 300,000 caged layers showed the compound had no detectable detrimental effect on fly development when used under field conditions. Results have also shown that conventional sugar baits are relatively ineffective in attracting flies, especially when compared to a sugar bait containing the attractant Muscamone. In laying house tests the attractant bait attracted flies within 10 minutes of application. Wetted attractant bait after 24 hours appeared to be four to five times more effective than dry and 15 to 20 times more so than conventional sugar baits. Soured feed or eggs were much less attractive to common and little house flies than the Muscamone bait. (Copyright 1977 - Poultry Science) (Abstract only)

4418-A11, B3, D3, E3

LAMB PERFORMANCE ON CAGE HEN MANURE ENSILED WITH CORRUGATED CARDBOARD

Poultry Husbandry Department, University of Missouri-Columbia, Columbia, Missouri 65201
J. M. Vandepopuliere, J. J. Lyons, and D. P. Hutcheson
Poultry Science, V. 56, No. 5, p. 1764, Sept., 1977.

Keywords: Diets, Ensiling, Poultry manure, Ground hay, Corrugated cardboard, Sheep, Performance.

Four silage diets were prepared using 23 percent of two types of fresh cage hen manure and 16 percent of two types of ensiling ingredients, ground hay and corrugated cardboard, in a 2 x 2 factorial design. One type manure was produced by hens on a corn-soybean meal diet and the other on a grain by-product diet. Ground corn (16 percent) and water (45 percent) were added to each mixture prior to ensiling. Corn silage supplemented with soybean meal was fed as the positive control All diets were supplemented with minerals as they were fed. Lambs were fed the diets in a 5 x 5 Latin Square design. Growth and feed conversion were evaluated during the 50 day study. The average daily performance on corn silage was 0.13 kg. gain and 8.6 kg. feed/kg. Daily gain and feed conversion on corn-soy-manure silage was 0.06 and 17.0 compared with grain by-product-manure silage of 0.25 and 4.2. Daily gain was 0.17 and 0.14 and feed conversion 9.1 and 12.0, respectively, on grass hay and corrugated cardboard. (Copyright 1977 - Poultry Science)

4419-A11, B3, E3

EFFECTS OF FERMENTED AND NON-FERMENTED POULTRY MANURE SILAGE ON BROILER CHICK GROWTH

Department of Animal Sciences, Colorado State University, Fort Collins, Colorado 80523
B. A. Watkins, B. F. Miller and E. W. Kienholz
Poultry Science, V. 56, No. 5, p. 1768, Sept., 1977.

Keywords: Refeeding, Poultry manure silage, Diets, Poultry, Performance.

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4420-A8, B1, C2, E2

A STUDY ON THE RELATIVE EFFICIENCY OF ORGANIC MANURES AND THE EFFECT OF SALINITY ON ITS MINERALISATION IN BRACKISHWATER FISH FARM SOIL

Estaurine Fisheries Research Unit of Central Inland Fisheries Research Institute, Barrackpore, India
S. R. Ghosh
Aquaculture, V. 5, No. 4, p. 359-366, June, 1975. 5 fig., 4 tab., 11 ref.

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4421-A11, B3, C2, D3, E3

EFFECT OF INCLUDING ENSILED BROILER-HOUSE LITTER IN THE RATIONS OF SHEEP ON THE DIGESTIBILITY OF NUTRIENTS AND THE RETENTION OF NITROGEN

Department of Animal Husbandry, University of Sydney, Camden, New South Wales
G. F. L. Jacobs and J. Leibholz
Australian Journal of Experimental Agriculture and Animal Husbandry, V. 17, No. 84, p. 43-47, Feb., 1977. 2 tab., 27 ref.

Keywords: Refeeding, Ensiling, Poultry litter, Sheep, Digestibility, Nutrients, Nitrogen retention, Diets, Barley.

The palatability and nutritive value of rations for sheep containing ensiled broiler-house litter and crushed barley (1:1 ratio) were compared with rations containing unprocessed broiler-house litter and barley. The ensiling of poultry litter together with barley (30 percent moisture) for three or six weeks resulted in increased feed intakes compared with diets containing poultry litter ensiled alone for three or six weeks and mixed with barley or a diet in which neither poultry litter nor the barley were ensiled. The nitrogen digestibility of the totally ensiled diets was greater than that of the other diets when these values were corrected for differences in feed intake by covariance. Nitrogen retention by the sheep fed the totally ensiled diets was also greater than when they were fed the other diets. The greater feed intakes and nitrogen retention of the sheep when fed the totally ensiled diets compared with those diets that were partially ensiled or not ensiled at all may have been due to a change in the form of nitrogen and to the production of volatile fatty acids during the fermentation of the rations. (Copyright 1977 - Australian Journal of Experimental Agriculture and Animal Husbandry)

4422-B2, C2, C3, D3, E3

MICROFLORA OF ENSILED MANURE-BLENDED FEED, CORN, AND SORGHUM SILAGES

Department of Animal and Dairy Sciences Agricultural Experiment Station, Auburn University, Auburn, Alabama 36830
T. A. McCaskey and J. L. Walters
72nd Annual Meeting, American Dairy Science Association, Iowa State University, Ames, Iowa, June 26-29, 1977, p. 170-172. 2 fig., 2 tab.

Keywords: Ensiling, Feeds, Manure-blended feed, Corn silage, Sorghum silage, Fermentation, pH, Microorganisms.

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4423-A8, B5, C2, E2

NO FERTILIZER, SOIL TEST FERTILIZATION, AND HEAVY FERTILIZATION OF CORN -- WHAT HAPPENS WITH EACH CASE?

Department of Plant and Soil Science, University of Tennessee, Knoxville, Tennessee
W. L. Parks and L. Safley
Tennessee Farm and Home Science, Progress Report 102, p. 23-25, April, May, June 1977. 5 tab.

Keywords: Fertilizers, Manure, Corn production, Application rates, Crop response, Rainfall, pH, Phosphorus, Potassium, Nitrogen.

Data from a small corn fertilization experiment involving 4 treatments on a Dickson soil at the Highland Rim Experiment Station in Tennessee is presented. The 4 treatments were: (1) no fertilizer, (2) soil test fertilization, (3) high fertilization plus minor elements, and (4) high fertilization plus minor elements + manure. There were 2 replications of each treatment from 1962 through 1975. Fifteen years of continuous corn with no fertilizer averaged 54.1 bushels per acre. The soil test fertilization treatment received 120 lbs. of nitrogen/acre/year. No phosphate or potash was applied during the first 3 years. Thirty lbs. per acre of P_2O_5 and K_2O were applied in 1965, 1966, 1968, and 1972. Fifty lbs. per acre of P_2O_5 and K_2O were applied in all other years. This treatment averaged 77.3 bushels/acre over the 15-year period. Applying high rates of fertilizer each year, 200-100-300 pounds of N, P_2O_5, and K_2O/acre, respectively, plus minor elements (50 lbs/acre of Es-Min-El), produced the same average yield as the soil test fertilization. Adding 10 tons of barnyard manure per acre to this high fertilization rate increased the average yield to 91 bushels per acre. This means that the 10 tons of manure was worth 13.7 bushels of corn, probably because of the improvement of the physical characteristics of the soil. The manure treatment produced the highest yields every year except 1967 when there was a 3.8 bushel per acre yield reduction. Additional data indicates that if an energy crisis forces farmers to "no fertilizer" farming, corn yields in the 45 to 50 bushels per acre range may be expected if the soil has been limed and has a high level of available phosphorus and potassium. Adding 10 tons of manure per acre could increase the expected yields to over 60 bushels per acre. Even higher yields would be expected on soils having good nutrient supply and which are better suited for corn production. (Merryman-East Central)

4424-A5, A12, B1, C2

ANALYZING NITRATES IN WELL WATER

Bel Air, Maryland
W. W. Whitlock, Jr.
Water & Sewage Works, V. 124, No. 3, p. 63, March, 1977. 1 fig.

Keywords: Sampling, Nitrates, Well water, Maryland, Barnyards, Feedlots, Manure, Methemoglobinemia.

A routine free water sampling program in Harford County, Maryland, has uncovered scattered cases of severe nitrate contamination of ground water, due to the manure concentrations in barnyards and feedlots in some parts of the county. Nitrates have a hazardous effect specifically for infants between 6 and 18 months old (Methemoglobinemia) which reduces the oxygen transport capability of the blood and can result in brain damage or death. Whenever nitrate levels greater than 10 ppm are observed in samples, local procedure requires notification of the resident, sampling of adjacent wells if possible, periodic follow-up at varying intervals, and sampling of water beneath undeveloped lots before issuing building permits. Extensive, frequent surveys will be necessary to verify contamination fluctuation trends and to determine possible relationships to weather, soil content, ground water movement, etc. (Eberle-NWWA; Water Resources Scientific Information Center)

4425-A3, A5, B1, C2

GROUND-WATER QUALITY VARIATION IN PHELPS COUNTY, MISSOURI

Watershed Scientist, U.S. Forest Service, National Forests in Missouri, Rolla, Missouri 65401
C. P. Tryon
Ground Water, V. 14, No. 4, p. 214-223, July-Aug., 1976. 10 fig., 2 tab., 17 ref.

Keywords: Groundwater quality, Missouri, Nitrates, Coliforms, Wells, Pasture land, Manure, Fertilizers, Agricultural runoff, Leaching, Sewage.

Information from 675 water wells in and around Phelps County, Missouri shows that discrete areas of differing ground-water quality can be identified and mapped. The best quality groundwater, as judged by its low nitrate content and coliform bacteria density, is found in areas of relatively little agricultural (pasture and livestock) land use. The adverse effect of agricultural land use on groundwater quality is more severe in the intensely developed karst than in the less intensely developed. Rural population density and soil association variations have no readily discernible effects on ground-water quality. Nitrate content varies seasonally and in response to rainfall, and decreases with increasing well depth. Coliform bacteria density is positively correlated with nitrate content. (Copyright 1976 - Ground Water)

4426-A2, A4, B1, D3

PROJECTS IN PROGRESS. SOME FEEDLOT INS AND OUTS

Agricultural Experiment Station, Utah State University, Logan, Utah 84322
L. M. Cox
Utah Science, V. 38, No. 3, p. 91-92, Sept., 1977.

Keywords: Water pollution, Utah, Feedlots, Agricultural runoff, Computer models, Overland flow.

Dennis George and Dan Filip (Research Assistant Professor and Research Biologist, respectively, of the Utah Water Research Laboratory), in conjunction with William Grenney and James Reynolds, have just completed the first year of research designed to determine if small feedlots clustering in river basins are polluting local streams. After simultaneously monitoring a network of small streams that drains into the Little Bear River and several feedlots in a different part of the Little Bear River Basin, the team (which includes graduate student Steve Wieneke and a number of well qualified technicians), is ready to start inserting data into a computer model of the limited network of streams. Later the Basin's entire stream system will be modelled. These models should facilitate valid projections of future water pollution events, and should be readily applicable to comparable river basins. The models will also indicate the pollution-processing capabilities of specific streams in wet, dry, and normal years. An accompanying study is to be conducted in Cache Valley in which a minimum of 2 feedlots will be used as test sites for a "greenbelt" or overland-flow approach to treating livestock wastes. In each case, the animals will be fed in an area removed from the stream and the animals will have no direct access to the water. Grass will be established between the area where the animals are to be held and the stream. This grass should effectively pre-filter any potential stream pollutants. (Merryman-East Central)

4427-A2, A3

AGRICULTURAL RUNOFF: A BIBLIOGRAPHY. VOLUME 2.

U.S. Department of Interior
OWRT/WRSIC 76-203, Agricultural Runoff: A Bibliography, V. 2, July, 1976, 495 p.

Keywords: Agricultural runoff, Bibliographies.

Agricultural Runoff, Volume 2, is another in a series of planned bibilographies in water resources to be produced wholly from the information base comprising the Selected Water Resources Abstracts (SWRA). At the time of search for this bibliography, the data base had 95,781 abstracts covering SWRA through April 15, 1976 (Volume 9, Number 8). Included are three indexes: Significant Description Index (blue pages), Comprehensive Index (yellow pages) and Author Index (green pages). Volume 2 covers the period from January, 1972 through April, 1976. (Bates-East Central University) (Microfiche only)

4428-A2, B2, D1, D3, E1

ENGINEER EXPLAINS NEW WASTE RUNOFF SYSTEM

Anonymous
Feedstuffs, V. 49, No. 16, p. 15, April 18, 1977. 1 fig.

Keywords: Feedlots, Agricultural runoff, Water pollution control, Settling, Separation techniques, Serpentine grassed waterway, Costs, Biological treatment, Labor.

University of Nebraska agricultural engineer E. A. Alson reported on a new method of draining feedlots to comply with pollution standards at a meeting of the Mid-Central branch of the American Society of Agricultural Engineers held in St. Joseph, Missouri. The new system uses the serpentine or switchback design with a grassed waterway to handle runoff from open lots. The runoff is passed through 2 wire screen debris traps to collect solids. The liquid then passes to a holding pond where it can be drained through the switchback system at periodic intervals. The solids load on the system is reduced by mechanical scraping of the lots. The system promises to be less costly to construct and will require less labor to operate than systems that require pumping or hauling liquids to the fields. (Merryman-East Central) had no detectable detrimental effect on fly development when used under field conditions. Results have also shown that conventional sugar baits are relatively ineffective in attracting flies, especially when compared to a sugar bait containing the attractant Muscamone. In laying house tests the attractant bait attracted flies within 10 minutes of application. Wetted attractant bait after 24 hours appeared to be four to five times more effective than dry and 15 to 20 times more so than conventional sugar baits. Soured feed or eggs were much less attractive to common and little house flies than the Muscamone bait. (Copyright 1977 - Poultry Science) (Abstract only)

4418-A11, B3, D3, E3

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4419-A11, B3, E3

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4420-A8, B1, C2, E2

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4421-A11, B3, C2, D3, E3

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4422-B2, C2, C3, D3, E3

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4423-A8, B5, C2, E2

NO FERTILIZER, SOIL TEST FERTILIZATION, AND HEAVY FERTILIZATION OF CORN -- WHAT HAPPENS WITH EACH CASE?

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W. L. Parks and L. Safley
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4424-A5, A12, B1, C2

ANALYZING NITRATES IN WELL WATER

Bel Air, Maryland
W. W. Whitlock, Jr.
Water & Sewage Works, V. 124, No. 3, p. 63, March, 1977. 1 fig.

Keywords: Sampling, Nitrates, Well water, Maryland, Barnyards, Feedlots, Manure, Methemoglobinemia.

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4425-A3, A5, B1, C2

GROUND-WATER QUALITY VARIATION IN PHELPS COUNTY, MISSOURI

Watershed Scientist, U.S. Forest Service, National Forests in Missouri, Rolla, Missouri 65401
C. P. Tryon
Ground Water, V. 14, No. 4, p. 214-223, July-Aug., 1976. 10 fig., 2 tab., 17 ref.

Keywords: Groundwater quality, Missouri, Nitrates, Coliforms, Wells, Pasture land, Manure, Fertilizers, Agricultural runoff, Leaching, Sewage.

Information from 675 water wells in and around Phelps County, Missouri shows that discrete areas of differing ground-water quality can be identified and mapped. The best quality groundwater, as judged by its low nitrate content and coliform bacteria density, is found in areas of relatively little agricultural (pasture and livestock) land use. The adverse effect of agricultural land use on groundwater quality is more severe in the intensely developed karst than in the less intensely developed. Rural population density and soil association variations have no readily discernible effects on ground-water quality. Nitrate content varies seasonally and in response to rainfall, and decreases with increasing well depth. Coliform bacteria density is positively correlated with nitrate content. (Copyright 1976 - Ground Water)

4426-A2, A4, B1, D3

PROJECTS IN PROGRESS. SOME FEEDLOT INS AND OUTS

Agricultural Experiment Station, Utah State University, Logan, Utah 84322
L. M. Cox
Utah Science, V. 38, No. 3, p. 91-92, Sept., 1977.

Keywords: Water pollution, Utah, Feedlots, Agricultural runoff, Computer models, Overland flow.

Dennis George and Dan Filip (Research Assistant Professor and Research Biologist, respectively, of the Utah Water Research Laboratory), in conjunction with William Grenney and James Reynolds, have just completed the first year of research designed to determine if small feedlots clustering in river basins are polluting local streams. After simultaneously monitoring a network of small streams that drains into the Little Bear River and several feedlots in a different part of the Little Bear River Basin, the team (which includes graduate student Steve Wieneke and a number of well qualified technicians), is ready to start inserting data into a computer model of the limited network of streams. Later the Basin's entire stream system will be modelled. These models should facilitate valid projections of future water pollution events, and should be readily applicable to comparable river basins. The models will also indicate the pollution-processing capabilities of specific streams in wet, dry, and normal years. An accompanying study is to be conducted in Cache Valley in which a minimum of 2 feedlots will be used as test sites for a ''greenbelt'' or overland-flow approach to treating livestock wastes. In each case, the animals will be fed in an area removed from the stream and the animals will have no direct access to the water. Grass will be established between the area where the animals are to be held and the stream. This grass should effectively pre-filter any potential stream pollutants. (Merryman-East Central)

4427-A2, A3

AGRICULTURAL RUNOFF: A BIBLIOGRAPHY. VOLUME 2.

U.S. Department of Interior
OWRT/WRSIC 76-203, Agricultural Runoff: A Bibliography, V. 2, July, 1976, 495 p.

Keywords: Agricultural runoff, Bibliographies.

Agricultural Runoff, Volume 2, is another in a series of planned bibliographies in water resources to be produced wholly from the information base comprising the Selected Water Resources Abstracts (SWRA). At the time of search for this bibliography, the data base had 95,781 abstracts covering SWRA through April 15, 1976 (Volume 9, Number 8). Included are three indexes: Significant Description Index (blue pages), Comprehensive Index (yellow pages) and Author Index (green pages). Volume 2 covers the period from January, 1972 through April, 1976. (Bates-East Central University) (Microfiche only)

4428-A2, B2, D1, D3, E1

ENGINEER EXPLAINS NEW WASTE RUNOFF SYSTEM

Anonymous
Feedstuffs, V. 49, No. 16, p. 15, April 18, 1977. 1 fig.

Keywords: Feedlots, Agricultural runoff, Water pollution control, Settling, Separation techniques, Serpentine grassed waterway, Costs, Biological treatment, Labor.

University of Nebraska agricultural engineer E. A. Alson reported on a new method of draining feedlots to comply with pollution standards at a meeting of the Mid-Central branch of the American Society of Agricultural Engineers held in St. Joseph, Missouri. The new system uses the serpentine or switchback design with a grassed waterway to handle runoff from open lots. The runoff is passed through 2 wire screen debris traps to collect solids. The liquid then passes to a holding pond where it can be drained through the switchback system at periodic intervals. The solids load on the system is reduced by mechanical scraping of the lots. The system promises to be less costly to construct and will require less labor to operate than systems that require pumping or hauling liquids to the fields. (Merryman-East Central)

4429-A8, B5, C2, E2

MANURE: LONG-TERM STUDY

Panhandle Experiment Station, University of Nebraska, Lincoln, Nebraska 68506
L. Chesnin and F. N. Anderson
Quarterly, Nebraska Agricultural Experiment Station, V. 22, No. 3, p. 24-26, Autumn, 1975. 2 fig., 1 tab.

Keywords: Manure, Land application, Crop response, Corn, Nutrients, Nitrogen, Phosphorus, Zinc, Iron, Manganese, Copper, Heavy metals

The oldest investigation of the long term effects of manure application in states west of the Missouri River has been conducted at the University of Nebraska Panhandle Experiment Station. From 1912 to 1941, the experiment involved growing irrigated corn on a Tripp soil with no manure or commercial fertilizer applied. In 1942, the original continuous corn plot was divided. Half receive 12 tons/acre of wet barnyard manure each year, and the other half received no manure. From 1942 to 1970 the non-manured corn plot averaged 30 bushels/acre while the manured plot averaged 96 bushels/acre. The application of manure decreased the bulk density and increased the rate of water infiltration into the Tripp soil from 0.2 to 2.7 inches per hour after 2 hours. The application of manure lowered the PH of the surface 8 inches and increased the organic matter and total nitrogen contents of this soil depth. The total nitrogen content of the manured Tripp soil was nearly to the level of its virgin state as measured in 1912. Annual plowing down of manure to a depth of 8 inches resulted in a higher level of available phosphorus to a depth of 2 feet. Annual application of manure resulted in a marked increase in the available zinc content of the Tripp soil to a depth of 8 inches. Manure applications increased the depth to free $CaCo_2$ to 30 inches as compared to 12 inches for the non-manured plot. In the 0-8 inch depth, the level of available iron was higher in the non-manured plot. Samples collected from below the 8-inch depth were higher in extractable iron in the manured plot. In general, the levels of available manganese were higher in the manured than in the non-manured plot. The levels of available copper were only slightly higher in the manured than in the non-manured portion of the continuous corn plot. Organic complexed copper decreased with depth and was adequate down to 24 inches but deficient below this depth. The relatively gradual decrease in levels with depth was not observed in the case of the other heavy metals studied in this investigation. It was concluded that the use of manure in irrigation soil management would help to reverse the process of soil depletion through crop production practices and give the added benefit of increased yields along with the improved soil. (Bates-East Central)

4430-B3, C1, C3, D3

LABORATORY SIZE COMPOSTING UNIT FOR AGRICULTURAL WASTE MATERIALS

R. D. Estes, C. R. Mote, and C. L. Griffis
Arkansas Farm Research, V. 26, No. 2, p. 2, March-April, 1977. 1 fig.

Keywords: Composting, Equipment, Temperature, Moisture content, Dairy manure, Carbon dioxide.

A bench-scale composting unit has been built that permits intensive laboratory monitoring of the aerobic process that occurs naturally in a compost pile. The unit has a capacity for approximately 1000 cubic centimeters of moist organic material. The material used in the initial runs of the composting unit was made up of 1/6 cotton gin trash and 5/6 fresh dairy cow manure, by weight. Temperature and carbon dioxide levels were monitored and were found to be sufficient for natural composting to occur. The rapid rise, leveling off, and gradual decline in both temperature and carbon dioxide evolution curves corresponded to the normal growth rate curve for microbial populations as the organic components were consumed. The temperatures at the center of the compost for batch number 1 were in the thermophililic range for about 72 hours. A mass balance calculation was made for each test batch as a further check on data accuracy. In the first batch, the mass taken out of the unit differed from the mass put into the unit by only 0.3 percent of the initial sample weight. For the second batch, the difference was 0.9 percent of the initial sample weight. The trial runs of the unit indicated two problems. One was in temperature control and the other had to do with the control of the moisture humidity content of the air in the digestor. Since completion of the two test runs, a new temperature controller has been built and successfully tested. Modifications of the air circulation system are being tested. Nine of the bench-scale composting units will be built for more extensive study of the composting process. Results of these laboratory tests will be used to develop criteria for natural composting of any and all agricultural waste methods. (Bates-East Central)

4431-A11, B3, C2, E3

GOOD GAINS ON POULTRY WASTE, HIGH FIBER DIET

Anonymous
Wallaces Farmer, V. 102, No. 16, p. 81, Aug. 27, 1977.

Keywords: Dried poultry wastes, Refeeding, Nitrogen, High fiber diets, Sheep, Performance.

Poultry manure is superior to urea as a nitrogen source in high fiber diets fed to growing lambs, says Lewis Smith, USDA's Agricultural Research Service animal scientist. In research at Beltsville Agricultural Research Center, Smith divided 48 lambs into four groups. They were fed complete pelleted diets containing either cornstalks or wheat straw as the fiber source and either dehydrated poultry excreta or urea as supplements providing about 35 percent of the total dietary nitrogen. These diets were fed for 60 days. On the higher fiber diets, lambs gained an average of 91 grams/day. Lambs grew best on diets containing wheat straw supplemented with poultry excreta. After 60 days, these same lambs were divided into two groups and fed ground ear corn in place of the wheat straw and corn stalks. They were again supplemented with urea or dehydrated poultry manure which provided 20 percent of total dietary nitrogen and were fed for 60 days. This time the source of nitrogen had no effect on the weight gains of the lambs. The sheep gained an average of 201 grams/day. (Bates-East Central)

4432-A11, C3

STUDIES ON BACTERIOPHAGE DISTRIBUTION: VIRULENT AND TEMPERATE BACTERIOPHAGE CONTENT OF MAMMALIAN FECES

Department of Botany, University of Hong Kong, Hong Kong, China
T. S. Dhillon, E. E. S. Dhillon, H. C. Chau, W. K. Li, and A. H. C. Tsang
Applied and Environmental Microbiology, V. 32, No. 1, p. 68-74, July, 1976. 6 tab., 15 ref.

Keywords: Cattle wastes, Swine wastes, Human wastes, Bacteriophages, Salmonella.

Freshly voided samples of the feces of cows, pigs, and humans were analyzed for the enumeration of cell-free plaque-forming units (PFU) of coliphages and *Salmonella* phages. Coliphage PFU counts per gram (wet weight) of feces were found to range from less than 10^1 to $> 10^7$. *Salmonella* phages were found in three out of five porcine samples, but none were found in the four bovine samples analyzed. Virulent coliphages related to the ϕX174/S13 serological group showed some "habitat preference" in that the S13 type of phages was found only in pig feces, whereas the ϕX174 type of phages was found only in cow dung. Temperature coliphages were detectable in a majority of samples of both human and porcine origin but were infrequently found in bovine samples. About 80 percent of the temperature coliphages of fecal origin have been found to be serologically related to phage HK022 (Dhillon and Dhillon, 1973), and all are efficiently inducible by ultraviolet light irradiation. However, considerable diversity within the group was found when the prophage immunity pattern of 10 randomly selected isolates was examined. (Copyright 1976-Applied and Environmental Microbiology)

4433-B3, C2, D3, E3

WILLE COMPOST TANK: A DESIGN STUDY FOR A CONTINUOUS-FLOW COMPOST TANK USED IN RECLAIMING BEDDING MATERIAL FROM A MIXTURE OF BEDDING MATERIAL AND ANIMAL WASTES

Iowa State University, Ames, Iowa
J. L. Wille and R. J. Smith
Paper presented at AICHE/EPA Third National Conference, June 27-30, 1976, p. 517-519. 1 fig., 4 ref.

Keywords: Recycling, Bedding, Animal wastes, Composting, Design, Aeration rate, Thermophilic temperature, Carbon, Nitrogen, Agitation, pH, Bedding, Soil conditioners.

The increase in confinement housing may require an increase in bedding material used for animal comfort and to absorb waste liquids. The collection, transport, and treatment of semi-solid, manure-bedding mixtures present problems unique to livestock production that are similar to sewage and industrial sludges. These problems may be simplified if we can find methods that reduce both the amount of material used in the operation and the amount that must be finally disposed of. Perhaps composting is one answer. A compost tank was designed which took into account the necessary variables of composting -- aeration rate, thermophilic conditions, carbon-to-nitrogen rates, agitation, and pH. The compost tank was circular, 25 ft. in diameter, and 30 ft. high. The tank was divided horizontally. A flail agitator was used to mix the top portion. Fans connected to an underfloor tunnel system diffused air into the compost tank. Material to be composted was daily elevated into the compost tank at a maximum rate of 132 ft^3/day. Initially, the material was dropped directly into an empty space above 1 of 10 perforated doors. On the tenth day of composting, the material was dropped to the lower section, thus clearing the space in the upper layer for new material that requires active agitation and aeration. The material that dropped into the lower layer was then leveled off by a traveling rake and was allowed to complete the composting process during its 30- to 40-day travel to the bottom unloader. The resulting material was suitable for bedding or use as a soil conditioner. Because composting reduced the total volume and produced a material which is biologically stable, the resulting compost may be used for bedding or as a soil conditioner. (Merryman-East Central) (Microfiche only)

4434-A4, C2, C3

MICROBIOLOGY AND WATER QUALITY IN A TRIBUTARY OF CAYUGA LAKE

Cornell University, Ithaca, New York
M. Khare, C. Thomas, and N. Dondero
Research Project Technical Completion Report, Project No. A-030-NY, 1975, 126 p. 65 fig., 10 tab.

Keywords: Water quality, Water pollution control, Feedlots, Taughannock Creek, Cayuga Lake, New York, Cattle, Watersheds, Sampling, Biochemical oxygen demand, Coliforms, Nitrogen, Phosphate, Dissolved oxygen.

The effects of a cattle feedlot as a source of water pollution on Taughannock Creek, a Tributary of Cayuga Lake, were studied in terms of several common chemical parameters and in terms of most probable numbers of coliforms, fecal coliforms, fecal streptococci, denitrifiers, nitrifiers, and total plate counts. Data were highly variable, but the feedlot clearly contributed to pollution of the stream, although concentrations did not indicate severe pollution conditions. The feedlot contributed significant amounts of nitrogen and phosphate to the stream system and potentially to Cayuga Lake. Additional nitrogen probably originated from soils and groundwater in the drainage basin. Coliform, fecal coliform, and fecal streptococcus levels were conspicuously high at the feedlot. Although the concentrations of fecal coliforms and fecal streptococci quickly subsided and were low at the mouth of Taughanock Creek, the constant presence of *Salmonella* supported their utility as indicators of sanitary quality of surface waters. Many of the bacteria were transients, entering the water at the feedlot and disappearing downstream. (Khare-Cornell) (Microfiche only)

4435-B1, D2, E2, E3, F1

OPPORTUNITIES FOR MORE EFFECTIVE USE OF ANIMAL WASTES

U.S. General Accounting Office
E. B. Staats
General Accounting Office Report 76-101, June 14, 1976, 40 p.

Keywords: Waste disposal, Land disposal, Recycling, Pyrolysis, Ammonia synthesis gas, Confinement pens, Feedlots, Livestock, Technology, Economics.

EPA's animal waste research program has been concentrated on the land application of the manure both as fertilizer and as a means of disposal. Although EPA has recognized the existence of various potential alternatives to land application, it has expended only minimal effort in developing these alternatives through small grants for laboratory research. An EPA official responsible for the Animal Feedlot Waste Research Program told us (the General Accounting Office) that EPA funded projects for ammonia synthesis gas production and production of useful products through pyrolysis were both at a stage where pilot plants have become necessary to test on a larger scale the results achieved in the laboratory. However, EPA officials said that EPA does not plan to proceed further with these methods. As discussed in chapter 2, our review identified several confinement operations, particularly holding pens for several meat packing plants which, because of their location in an urban area, were unable to dispose of accumulated manure to farmers for use as fertilizer. For these operations and for the large feedlots which may have disposal problems when operating at full capacity (currently operating nationally at about 50 percent) the various experimental technologies for manure use represent potential methods of solving the disposal problem. We believe that more research effort should be directed toward bringing such technologies to a commercially acceptable level of development including the determination of economic feasibility of the various alternatives. Of particular importance is the development and acceptability of those technologies, such as ammonia synthesis, which have shown promise in the laboratory but must now be tested on a larger scale to prove their practical commercial value. The General Accounting Office recommends that the Administrators of the Environmental Protection Agency and the Energy Research and Development Administration and the Secretary, Department of Agriculture enter into a joint agreement delineating responsibilities for the disposal and utilization of animal manure and provide for adequate coordination of activities. This agreement should provide assurance that innovative research projects, such as those discussed in this report, will be given adequate consideration for development to a stage where the economic and technical viability of the technology can be determined. (Staats-General Accounting Office)

4436-B1, E2, E3, F1

THE HAPPY EARTHWORM

Anonymous
Calf News, V. 15, No. 9, p. 14, Sept., 1977. 1 fig.

Keywords: Recycling, Cattle wastes, Paunch manure, Feedlots, Earthworms, Fertilizers, Economics.

John Vander Molen, a feedlot owner in Chino, California, raises earthworms on 3 acres near his feedlot. Every week, John feeds his earthworms manure from his 3,000 calves plus a topping of paunch material from a local packing plant. Every day he waters them. John even has to obtain manure from other sources to have enough. A pound of wigglers brings two dollars. Also, the worms leave "castings" which make the highest-quality fertilizer for shrubs and trees and house plants. A ton of such castings sells for about $25.00. (Merryman-East Central)

4437-A6, B2, E2, F2

HIS HOGS DON'T STINK

J. Wiebel
Wallaces Farmer, V. 102, No. 17, p. 26-27, Sept. 10, 1977. 1 fig.

Keywords: Confinement pens, Odor, Regulation, Iowa, Odor control, Swine, Slatted floors, Lagoons, Good housekeeping, Land spreading, Knifing.

The bulk of Iowa's new odor regulations become effective January 1, 1979. Basically, the regulations state that it takes 3 neighbors living within a 5-mile radius of a livestock operation to file a complaint to the Department of Environmental Quality. Odors must be bothersome at one of the complainant's homes for 12 or more hours a day for 10 or more days during a 30-day period. After January 1, 1978, lagoons (which are the source of the greatest number of odor complaints in Iowa) will not be allowed to be built unless a permit is secured from the Air Quality Commission. George Osborne, member of the Air Quality Commission of the Department of Environmental Quality and owner of a confined swine operation, says that odor control is 99 percent management. The main thing to do in controlling swine odor is to keep hog buildings clean. Keeping things clean is easier to do in total confinement than in open front facilities with an outdoor feeding floor. Totally slotted floors seem to work best in odor control. Narrow slats are better than wide slats, because there's less surface for manure to accumulate. Keeping hogs crowded so they work the manure off the slats and into the pits also helps. Osborne gives finishing hogs 6 sq. ft. of room and packs them 25 to a pen. While that's less space than is recommended by most engineers, Osborne says he can get by with it because he markets all his hogs when they reach 206 lbs. Adequate ventilation is also important. Iowa State University extension agricultural engineer Stu Melvin suggests that odors may be further controlled by keeping the solids content of pit manure above 5 percent and preferably 6 percent to 8 percent. Osborne eliminates much of the odor caused during land spreading by knifing it into the soil – except when the ground is frozen. (Merryman-East Central)

4438-A6, A7, B1, D1, F1

HOG HOUSE DUST CONTROL HELPS YOU BREATHE EASIER

J. Wiebel
Wallaces Farmer, V. 102, No. 17, p. 164-165, Sept. 10, 1977.

Keywords: Swine, Confinement buildings, Air pollution, Dust control, Ionization, Gases, Ammonia, Costs, Economics.

Hog house dust can cause coughing and sneezing for both man and beast. Unless a producer knows his hogs have a long standing problem with atrophic rhinitis or pneumonia, taking extra stress of air pollutants off the respiratory system may not be economically worthwhile. Even then, hog performance probably will not be improved. Whether or not dust removal pays depends upon whether you're talking about the animal or the operator. Hogmen suffering from asthma, hay fever or emphysema say dust removal systems help them breathe easier. Kelley Donham of the Institute of Agricultural Medicine at the University of Iowa says hog house dust is potentially dangerous to humans because 90 percent to 95 percent of it is less than 5 microns in size. This means it slips through the filtering mechanism in the nose and moves deep into the lungs whenever a person inhales. Dust removal may be achieved through ionization. This means that negative electrons are shot through the air to collide with dust particles and give them a negative charge. These negatively charged dust particles are then attracted to positive and neutral objects in the building and settle out of the atmosphere. Sixty to seventy-five percent of dust particles are removed. The big problem with the negatively charged dust particles is that they settle on gates, feeders, and other equipment which carry a positive or neutral charge. Corrosive gases absorbed by these dust particles may cause equipment to corrode faster than normal. Iowa State University agricultural engineer Dwaine Bundy is working on an accessory to ionization systems -- a positively charged collector panel which would attract much of the negatively charged dust. The collector panel could be washed down regularly to remove the dust entirely from the building. At present, cost of an ionization system is $1200 to $2500, depending upon the size of the confinement building. (Merryman-East Central)

4439-A8, B2, B5, C2, E2, F1
INJECTING MANURE CUTS CORN FERTILIZER COSTS

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 118-119, Sept. 10, 1977. 1 fig.

Keywords: Waste disposal, Land application, Soil injection, Crop response, Fertilizers, Nitrogen, Phosphorus, Potassium, Location, Economics.

Lloyd Arthur and his son Bill agree that injecting animal wastes reduces or eliminates odor problems and preserves more soil nutrients than is achieved by simply spreading the wastes. Their swine pits have a 3-month storage capacity. Emptying is done at 3-month intervals, beginning in January. January and April applications go on either soybean stubble or unplowed cornfields. At least one field of wheat is grown to provide stubble for waste injection in July. Wastes are spread on soybean stubble in October. With 400 acres of cropland nearby, the Arthurs seldom inject wastes in a field more often than every 5 years. The Arthurs are convinced that P and K supplied by swine wastes will carry a crop for only a year. Past that point, they apply commercial fertilizers. The Arthurs always apply some nitrogen. Tom Bache, who farms near Frankfort, Indiana, does much the same thing as the Arthurs. Bache feels that there is not much point in calculating the nutritive value of wastes when they're being applied at high rates because the wastes are not being utilized all that well. The main purpose is getting rid of the wastes. Bache expresses concern as to what might happen if adverse weather should make chiseling impossible some year. Options to meet such an event are to build a lagoon, to irrigate, or to add a second unit for injecting wastes. Bache also makes a point about the location of swine facilities and the location's effect on waste handling. He feels that larger producers might think seriously about locating swine facilities nearer the center of a section of land to facilitate ease in hauling. (Merryman-East Central)

4440-A8, B2, B5, C2, E2, F1
INJECTING MANURE PAYS WITH SAVED NITROGEN

Anonymous
Wallaces Farmer, V. 102, No. 16, p. 30, Aug. 27, 1977. 1 tab.

Keywords: Swine wastes, Cattle wastes, Soil injection, Surface spreading, Equipment costs, Injection costs, Nitrogen, Volatilization.

Higher investment and operating costs have kept some livestock producers from using injection manure disposal. However, a University of Illinois study shows that injecting manure more than compensates for higher costs by reducing nitrogen loss. Also odor is reduced. Liquid spreaders and injectors unload at about the same rate of 250 gal. per minute. The additional power cost is 19¢ per 1000 gal. of manure injected. The additional power cost of 19¢ per 1000 gal. plus the application price of the 1000 gal. makes the injection cost 89¢ more per 1000 gal. of manure than surface spreading. But surface spreading manure allows an average nitrogen loss of 31 percent for surface spread manure not incorporated for several days. At 10¢ per pound of nitrogen, the volatilization loss is about $1.55 per 1000 gal. of beef manure and $1.71 per 1000 gal. of swine manure. The injection systems assume a 5 percent volatilization loss during and after injection. Thus there is a loss of 25¢ per 1000 gal. of beef manure and 27¢ per 1000 gal. of swine manure. But injecting also saved $1.30 and $1.44, respectively, per 1000 gal. of beef and swine wastes injected. This more than covers the extra cost of 89¢ per 1000 gal. of manure for the injection systems. (Merryman-East Central)

4441-B1, C2, D1, D2, D3, E3, E4
MANURE AND ALGAE PRODUCE ANIMAL FEED

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 182, Sept. 10, 1977.

Keywords: Swine wastes, Livestock wastes, Recycling, By-product recovery, Algae, Substrates, Feeds, Protein, Lysine, Tryptophan.

Cornell University scientist Wilson Pond reports that a blue-green algae, *Arthrospira platensis*, has been found to grow rapidly in the residue of swine waste following methane production. Pond says the algae has 60 percent protein content as compared to corn with 10 percent and wheat with 12-15 percent. Also, the algae is high in lysine and tryptophan, two amino acids necessary for growth and survival and found only at low levels in most plants. The algae grows quickly. Based on experimental data, a theoretical projection (on a dry matter basis) of 20-40 tons of algae per acre per year could be made. By comparison, corn yields 3 tons of dry matter per acre. Pond feels the algae could be fed to animals in the same form in which it is produced or it could be ensiled or spread out to dry. The process requires little land and would not compete with crop space. Manures from other animals are being tested as substrates. Another species of the algae, maxima, is being used experimentally in Mexico. (Merryman-East Central)

4442-B1
MANURE LOADERS NEED CARE AND MAINTENANCE

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 144-145, Sept. 10, 1977.

Keywords: Manure loaders, Equipment, Maintenance, Safety.

Tips are given for getting full use out of hydraulic manure loaders, while holding down maintenance and operating costs. Because when the loader is in use, weight is transferred from the tractor's rear wheels to the front wheels, several things need to be done. All weights should be removed from the front frame and wheels. Tires should be inflated to recommended pressures. Steering should be checked for looseness and play. Rear weighting, necessary for traction, may be accomplished by putting liquid in the rear tires or by using wheel weights. If the loader is to be removed and installed often, some type of quick-on, quick-off rear weighting arrangement adds convenience. Pins or other attaching points required by the tractor hitch should be welded on. Rear tires should be set as wide apart as possible, consistent with shed doors or other openings. Dirt should be kept out of the system by observing these precautions: (1) Use only clean hydraulic fluid. (2) Handle fluid in clean containers only. (3) Clean all dirt away from the area around the filler opening before removing the plug. (4) Keep hydraulic connections clean when installing or removing the loader. The loader's hydraulic fluid should be checked daily. Only the recommended type, grade, or brand of fluid should be used. The loader should not be used for an extended time with the pressure relief valve operating. Pivot points should be greased regularly. Bucket linkage controls should also be oiled as a routine measure. Bolts and capscrews that attach the loader to the tractor should be regularly checked. Heavy bucket loads should be eased down slowly. For safety: (1) Operate the loader from the tractor seat only. (2) Carry the load low. (3) Operate at a reasonable speed. (4) Never operate with frayed hoses or leaky hydraulic system. (5) Never stand underneath a raised bucket. (6) Do not leave the bucket in a raised position. (7) Before uncoupling any hydraulic connections, stop the engine, and work the control valve back and forth several times to relieve any pressure in the system. (8) If possible, avoid operating sideways on a slope. (Merryman-East Central)

4443-B2, B4, E2
NEW WASTE COLLECTION AND STORAGE SYSTEM

Anonymous
Kansas Farmer, V. 115, No. 12, p. 36, July, 1977. 1 fig.

Keywords: Waste collection, Waste storage, Liquid wastes, Slurries, Minnesota, Confinement housing, Slatted floors, Earthen pit, Plastic pit liner, Land application, Knifing.

A new concept in livestock waste management systems was recently installed on a farm in Minnesota in conjunction with a factory-built confinement building. The new feature of the waste system is a prefabricated thermo-plastic waste collection pan that was installed in a simple excavation within the building footings just prior to the assembly of building components on site. The shallow (1 to 3 ft. depth) plastic pans collect wastes from the slatted floor of the confinement building and gravity feed the wastes by pipe line to a waste storage area. The wastes are held in air-tight storage in a patented structure called the "Controller." This air-tight waste storage "baggie" consists of a thermo-plastic pit liner and sealed floating cover that is installed in an earthen pit and holds 12 months' accumulation of waste. Since the slurry is always liquid, the farmer simply attaches his tank wagon to the outlet hose, agitates the wastes, removes the slurry and knifes it into the soil. (Merryman-East Central)

4444-A2, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, C1, C2, C3, D1, D3, E2, E3, F1, F2, F4

LIVESTOCK WASTE FACILITIES HANDBOOK

Midwest Plan Service. Livestock Wastes Subcommittee
Livestock Waste Facilities Handbook, Midwest Plan Service Publication 18, Iowa State University, 1975, 95 p. 61 fig., 50 tab.

Keywords: Livestock wastes, Waste storage, Waste treatment, Waste disposal, Regulation, Feedlots, Agricultural runoff, Gases Odor, Physical properties, Chemical properties, Waste collection, Runoff collection, Flushing gutters, Separation techniques, Biological treatment, Waste transport, Land application, Costs, Climate, Refeeding.

This publication deals with technology that is changing rapidly as a result of regulation, population growth patterns, land use and such variables as soil type, topography, climate, and management of livestock production. The publication is intended for: (1) those who plan, evaluate, or select waste handling systems, (2) those who work with farmers and their livestock problems, and who need some knowledge of waste handling systems, and (3) those who teach about waste handling, utilization, and disposal, and who need a resource on typical facilities. The publication considers the following major topics: (1) characteristics of animal wastes, (2) waste collection, (3) runoff collection, (4) flushing gutters, (5) waste storage, (6) liquid-solid separation, (7) biological treatment, (8) waste transport, (9) utilization and disposal of animal wastes, (10) cost estimating, (11) livestock weights (12) climate data, and (13) a glossary of terms. (Merryman-East Central)

4445-A6, A7, B1, C2

GUIDE TO EFFECTIVE MANURE PIT VENTILATION

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 222, Sept. 10, 1977.

Keywords: Odor, Gases, Air pollution, Swine, Confinement housing, Slatted floors, Ventilation, Ammonia, Methane, Carbon dioxide, Hydrogen sulfide, Organic acids.

Adequate ventilation may be the answer to swine manure odor and air pollution problems. A Swedish swine study revealed that gas concentrations are greater in the area between the manure's surface and slightly above the slatted floor than elsewhere in a confinement. A manure pit produces ammonia, methane, carbon dioxide, hydrogen sulfide gases, and small amounts of organic acids. To make pit ventilation work, manure must be kept at least 18 inches below the slats. According to Don James, Purdue University extension agricultural engineer, pit ventilation is worthless if the manure gets to within 6 to 12 inches of the slats. Airflow should be parallel with the slat beams so that beams will not cut airflow. Minimum ventilation rates are usually used in extremely cold weather, normal ventilation in spring and fall, and three times the normal rates in summer. Jones says pit ventilation provides more uniform air distribution, fewer dead spots, and lower odor problems at minimum rates than at normal or summer rates. Pit ventilation fans can be either mounted externally on building walls or mounted below ground in a concrete room. 20 cfm per sow is adequate ventilation for a well serviced fan system. (Merryman-East Central)

4446-B1, C3

EXAMINATION OF POULTRY LITTER FOR SALMONELLAE BY DIRECT CULTURE AND FLUORESCENT ANTIBODY TECHNIQUE

Department of Veterinary and Animal Sciences, University of Massachusetts, Amherst, Massachusetts 01002
C. F. Smyser and G. H. Snoeyenbos
Avian Diseases, V. 20, No. 3, p. 545-551, 1976. 3 tab., 16 ref.

Keywords: Poultry litter, Biological properties, Sampling, Salmonellae.

Direct culture and fluorescent antibody (FA) procedures were used for examining approximately 6200 samples of poultry floor or nest litter for salmonellae. Each sample was cultured directly in tetrathionate brilliant-green (TBG) broth, incubated at 42 C for 48 hours, and plated on brilliant green (BG) agar. The FA procedure was conducted from pools of 4-8 samples prepared by transferring 1 ml supernatant from TBG at 24 hr into 50 ml of either gram-negative (GN) broth, selenite cystine, or selenite brilliant-green sulfapyridine. After 6 hr of incubation at 42 C, BG agar plates were streaked from each pool, and smears were prepared for FA. Salmonella was isolated by plating from 268 of 854 pooled units. Recovery was 97 percent by direct culture, 86 percent from GN broth, and 57 percent from the selenite secondary enrichments. In the FA procedure, GN broth was superior to either of the selenites as the secondary medium from which to prepare smears, giving more FA-positive pools, a higher percentage of confirmed positives, and a lower percentage of false negative pools. A major deficiency of the FA technique was the high percentage of false-positive reactions as judged by inability to isolate salmonellae. From litter cultured directly in TBG, salmonellae were isolated from 97 percent of the total number of pools culturally positive by combined culture methods. (Copyright 1976 - Avian Diseases)

4447-B1, B2, B3, B4, D1, D2, D3, E2, F1

DECISION MODEL FOR ANIMAL MANURE HANDLING

L. M. Safley, Jr.
M.S. Thesis, Cornell University, Aug., 1974, 147 p. 12 fig., 2 tab., 21 ref.

Keywords: Waste management, Waste treatment, Waste storage, Liquid wastes, Solid wastes, Land disposal, Costs, Computer analysis, Computer models.

A technique for simultaneously evaluating several different confined livestock manure handling systems was developed. The technique consisted of a field worksheet for gathering information concerning the specific livestock operation and a computer program to assess a network representing the various systems in question. The manure handling systems were evaluated in terms of their yearly economic cost to the livestock operator. The land was considered to be the ultimate receptor of the manure in each system. Several factors were considered in developing the analysis package such as repair, depreciation, taxes, interest, insurance, manual labor, and initial costs of machinery and structures. The network employed was divided into the following five stages: (1) collection of manure, (2) manure treatment and solid storage, (3) liquid storage, (4) removal of liquid from storage, and (5) transporting from storage to land. Equations describing the cost of moving the animal manure from one stage to another were constructed for eleven systems. These eleven systems were chosen to represent a cross-section of the manure handling systems that are currently in use by operators and those under study. The analysis tool was developed to assist extension engineers and livestock producers in making decisions concerning the manure handling system to be employed. One analysis conducted, for instance, indicated that the conventional daily hauling system was not always the least expensive system as has been widely reported. (Safley-Cornell University)

4448-A4, A5, A8, A11, B5

CONVERT CITY SEWAGE TO FARM FERTILIZER

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 181, Sept. 10, 1977.

Keywords: Sewage sludge, Fertilizers, Land application, Heavy metals, Disease organisms, Crop response, Water pollution, Groundwater pollution, Runoff control, Composting.

Converting municipal sewage sludge to fertilizer to help dispose of this waste hasn't progressed as some people felt it would. One of the largest obstacles has been the heavy metal components of sewage which are dangerous to both plants and animals. Disease threat from the sludge has been another hazard. However, tests conducted by Edward Clapp of the USDA Agricultural Research Service, have indicated fertilization by such sludge is quite promising. Annual application of 4.5 tons of sludge per acre resulted in yields of 106 bu. of corn per acre, and 4.3 tons of reed canarygrass per acre. Control areas receiving conventional fertilizer yielded 102 bu. of corn per acre and 3.4 tons of reed canarygrass. Analyses revealed no difference in the heavy metal content of the corn grain or leaf tissue from sludge areas as a conventionally fertilized plot. Concentration of heavy metals in soil water was not increased by sludge application, and analysis of surface and groundwater showed no movement of potentially polluting materials out of the watershed. Results seem to indicate that this type of sludge may be used safely for agricitural purposes if the land is properly terraced for runoff control. Scientists are also developing composts for utilizing sewage sludge. Such compost would foster water retention, help prevent leaching of nutrients, and would raise the potassium level of the soil. (Merryman-East Central)

4449-A11, B1, C1

A RAPID METHOD OF MEASURING MOISTURE IN LITTER USED FOR BROILERS BROODED AT HIGH DENSITY

G, C, Harris, Jr., G. S. Nelson, T. A. Cole, D. Ingram, and J. Benson
Arkansas Farm Research, V. 26, No. 1, p. 6, Jan.-Feb., 1977. 2 fig., 1 tab.

Keywords: Poultry litter, Moisture content, Performance, Broilers, Density, Ventilation, Climatic conditions, Measurement, Delmhorst model F-4, Moisture detector, Oven drying.

Previous research on ventilation needs for high density brooding (0.4 sq ft of floor space per chick) showed that ventilation rates of 0.1, 0.4, 0.7, and 0.7 cfm per bird for the first 4 weeks gave best performance. However, data from recent tests conducted at these ventilation rates but at different times of the year revealed that the optimum ventilation for performance may not be simply a certain rate for a particular age. Daily climatic conditions may influence the amount of moisture removal by ventilation, and are probably more important than growers realize. Because a rapid method of measuring broiler litter moisture was needed for evaluating the changes in litter condition with various ventilation rates, comparisons were made between a direct-reading Delmhorst model F-4 moisture detector that is used for hay bales and the slower vacuum oven-drying method normally used in the laboratory. Comparable moisture percentages were determined by the 2 methods. The moisture detector tested should be a useful tool for poultry servicemen since it will permit instant read-out of the percent litter moisture at several locations within a house. (Merryman-East Central)

4450-A5, A8, B1, B5, C2, E2
NITRATE-NITROGEN REMOVAL FROM SOIL PROFILES BY ALFALFA

Soil Scientist, U.S. Department of Agriculture, Southwestern Great Plains Research Center, Bushland, Texas 79012
A. C. Mathers, B. A. Stewart, and B. Blair
Journal of Environmental Quality, V. 4, No. 3, p. 403-405, July-Sept., 1975. 3 fig., 3 tab., 12 ref.

Keywords: Nitrates, Soil profiles, Manure, Land application, Alfalfa, Crop response, Leaching, Groundwater quality.

Previously utilized Pullman clay loam plots that had received 0, 22, 45, 112, and 224 metric tons/ha of manure of ammonium nitrate (224 kg N/ha) annually for 3 years were used in a new study to determine the extent that nitrate could be removed by alfalfa. Nitrate-nitrogen and water contents of the soil profile were determined by 30-cm increments to a 6-m depth prior to planting. It was found that the amount of nitrate-nitrogen removed and the removal depth would depend upon such factors as available water and root activity. The depth of nitrate-nitrogen removal will depend on the rooting of the alfalfa. Alfalfa roots can extend to depths greater than 6 m. Alfalfa seems to have the capability to remove nitrate-nitrogen at depths below the rooting depth of most crops. Planting alfalfa on soil high in nitrate-nitrogen could reduce the amounts of nitrate-nitrogen leaching into groundwater. Total nitrogen uptake by alfalfa was directly related to alfalfa yield. (Merryman-East Central)

4451-A4, A9, B1, C1, C2, C3
THE NEEDS FOR WATER QUALITY MODELS ON AGRICULTURAL WATERSHEDS

Chief, Agro-Environmental Systems Branch, Southeast Environmental Research Laboratory, National Environmental Research Center-Corvallis, U.S. EPA, Athens, Georgia 30601
H. P. Nicholson
Journal of Environmental Quality, V. 4, No. 1, p. 21-23, Jan.-March, 1975. 6 ref.

Keywords: Water pollution, Point sources, Non-point sources, Agriculture, Municipal wastes, Industrial wastes, Watersheds, Pollution control, Sediments, Agricultural chemicals, Animal wastes, Crop residues, Pathogenic bacteria, Heavy metals, Mathematical models.

The Federal Water Pollution Control Act Amendments of 1972 emphasize the need to control pollution associated with agricultural activities as well as pollution associated with cities and industries. The full significance of agricultural pollution has not yet been determined. Since much agricultural pollution is from non-point sources, something more than the application of standard collection and treatment systems is needed for pollution control. Management of such pollution will depend heavily upon mathematical models now under development. Management programs should be planned and implemented for complete drainage basins. The potential agricultural pollutants that must be managed include sediments, agricultural chemicals, animal wastes, crop residues, pathogens, and possibly heavy metals. (Merryman-East Central)

4452-A3, A4, C2
PHOSPHORUS LOSS BY STREAM TRANSPORT FROM A RURAL WATERSHED: QUANTITIES, PROCESSES, AND SOURCES

University of Pennsylvania, Philadelphia, Pennsylvania
A. H. Johnson, D. R. Bouldin, E. A. Goyette, and A. M. Hedges
Journal of Environmental Quality, V. 5, No. 2, p. 148-157, April-June, 1976. 12 fig., 4 tab., 12 ref

Keywords: Water pollution sources, Sampling, Phosphorus, Watersheds, Suspended solids, Runoff, Point sources, Non-point sources, Sewage, Agriculture, Manure, Fertilizers, Dissolved phosphorus, Particular phosphorus.

Phosphorus losses by stream transport in Fall Creek, which drains a rural watershed in central New York, were studied during a 20-month period. Fall Creek was sampled at several locations over a range of discharge conditions. Sampling efforts were concentrated during storm runoff periods. Estimates of phosphorus loss were obtained, and estimates of the standard errors were calculated. Phosphorus loss associated with suspended solids accounted for 78 percent of the total exported. Dissolved inorganic fractions accounted for 14 percent. Dissolved organic fractions accounted for 8 percent. Approximately 22 percent of the dissolved phosphorus lost from the watershed was derived from diffuse sources associated with farming, 44 percent was derived from natural geochemical processes, and 34 percent from point source inputs. Less than 1 percent of the phosphorus applied to the landscape in chemical fertilizer and manure was lost from the watershed in dissolved form. (Merryman-East Central)

4453-B2, C2, D3, E3, F4
STATE OF THE ART -- METHANE GAS GENERATION FROM AGRICULTURAL WASTES

Montana Agricultural Experiment Station and Extension Agricultural Engineer, Montana State University, Bozeman, Montana
C. M. Milne
Cooperative Extension Service Folder 160, Montana State University, April, 1974. 4 p.

Keywords: State of the art, Agricultural wastes, Anaerobic digestion, Methane, Batch digesters, Continuous flow digesters, Temperature, pH, Loading rates, Recycling.

A mixture of gas containing methane can be obtained from an anaerobic digester operating on animal wastes or other organic materials. Skill and attention to many details are needed to make a system operate in a stable manner. The technology does not presently exist for practical systems of methane generation and utilization under United States economic conditions. Considerable research is being initiated throughout the United States so that practical application of methane generation form agricultural wastes may - or may not - become a reality in the future. (Milne-Montana State University)

4454-B3, C1, C2, D3, E3
A COMPLETE DISPOSAL-RECYCLE SCHEME FOR AGRICULTURAL SOLID WASTES

Tennessee State University, Nashville, Tennessee 37203
M. R. Busby, G. Tragitt, R. Norman, and K. Hillsman
Environmental Protection Agency Report EPA-600/2-77-089, May, 1977. 52 p. 23 fig., 7 tab., 18 ref.

Keywords: Solid wastes, Agricultural wastes, Cattle wastes, Anaerobic digestion, Recycling, Equipment, Design, Methane, Fertilizers, Feed supplements, Energy.

With the advent of the 70's, there has been an increasing national concern for the growing energy shortage as well as the problem of organic waste disposal. These two problems, while at first glance appear unrelated, are dealt with simultaneously by an anaerobic digestion process. Such a process produces not only a useful fuel, methane, but also is a potential source of a stabilized fertilizer and a nutritive supplement to animal diets. This biological process has been used for decades, but the economic feasibility of incorporating such a process on a typical small farm has not been clearly established. This investigation applied the anaerobic process to the production of methane gas and a stabilized sludge from cow manure and farm clippings in laboratory pilot plants as well as a full-scale (2,000 gal.) digester system. The quantity and quality of gas produced, the biochemical and chemical oxygen demands, and the nutritional value of the digested sludge for both the laboratory and full-scale plants were evaluated. (Busby-Tennessee State University)

4455-A5, B1, B5, C2, E2
EFFECTS OF METHODS AND RATES OF DAIRY MANURE APPLICATION ON SOIL WATER NITRATE LEVELS

M. J. Green
M.S. Thesis, Department of Agricultural Engineering, The Pennsylvania State University, Nov., 1976, 61 p. 13 fig., 12 tab., 39 ref.

Keywords: Dairy manure, Land application, Application rates, Application methods, Nitrates, Leaching, Groundwater pollution.

The United States Department of Health, Education and Welfare and the World Health Organization recommend that nitrate nitrogen levels do not exceed 10 mg/1 in drinking water. It has been shown that very high manure application rates result in nitrate leaching through the soil and may cause groundwater pollution. This thesis research was undertaken to evaluate the effects of varying application levels of dairy manure slurry applied under the various cultural practices as follows: sod versus bare soil, surface versus subsurface applications and spring versus fall applications. Measurements of ammonia volatilization, nitrate concentrations in soil water, and plant uptake of nitrogen are included in determining a nitrogen balance. Conclusions drawn from the study were: (1) Ammonia volatilization rates remain nearly the same with varying application rates and cultural practices. An increase in temperature appeared to increase the volatilization. (2) The soil water nitrate nitrogen concentrations are not expected to exceed 10 mg/1 at the four-foot level the first year with application rates as high as 520 lbs/acre of nitrogen as manure applied during fall and 904 lbs/acre of nitrogen applied during spring. (3) Sod had a very positive effect in reducing soil water nitrate concentrations. (4) There was no noticeable difference in soil water nitrate and chloride concentrations in relation to surface versus sub-surface applied manure. (Merryman-East Central)

4456-A2, A5, B3, B4, C2
NITROGEN MOVEMENT NEAR SURFACE MANURE STORAGES

Soil Research Institute and Engineering Research Service, Canada Agriculture, Ottawa, Ontario K1A 0C6, Canada
F. J. Sowden and F. R. Hore
Canadian Journal of Soil Science, V. 56, No. 3, p. 223-231, Aug., 1976. 3 fig., 3 tab., 16 ref.

Keywords: Waste storage, Manure pit, Nutrients, Nitrates, Ammonium, Phosphates, Leaching, Overflow, Agricultural runoff, Groundwater pollution.

No evidence of serious groundwater contamination by excess nutrients from solid manure storage areas that had been used for over 30 yr at the Experimental Farm, Ottawa was found in an investigation that was carried out over a period of 4 yr. One storage area was on a concrete base and the other was located on a gravel base. The water table was usually above the 275-cm depth at both sites. Two unused shallow dug wells less than 250 m from the storage areas were not contaminated by nitrate, ammonium or phosphate. Water from piezometers installed at 275- and 425-cm depths near the gravel base storage area was always low in nitrate and ammonium, but sometimes appreciable levels of nitrate were found in water from a 122-cm deep piezometer. Water from piezometers installed at 122- and 275-cm depths near the concrete base storage area usually contained nitrate and ammonium. Water from piezometers installed 213 and 241 m from the storage areas in the direction of groundwater flow contained little nitrate or ammonium. The conditions prevailing in the area and the variation in the nitrate content of the groundwater during the seasons suggested that much of the nitrate originating from the storage areas was denitrified at or near the water table. (Copyright 1976 - Canadian Journal of Soil Science)

4457-A4, A6, A7, A8, B1, C2, D3, E2, E3
AGRICULTURE'S ROLE IN ENVIRONMENTAL QUALITY

Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland 20705
R. C. Yeck
Pur-O-Sphere Convention, Kiamesha Lake, New York March 22, 1971, 10 p.

Keywords: Agriculture, Feedlots, Water pollution, Odor, Waste management, Land disposal, Nitrates, Toxicity, Research, Cost sharing, Agricultural Stabilization and Conservation Service, Farmers Home Administration, Refeeding, Ensiling, Proteins, Algae, Air Pollution.

While Mr. Yeck was asked to discuss some of the specific activities of the U.S. Department of Agriculture, his speech was much more general than that. Mr. Yeck established that feedlot production of animals has led to problems with waste management. Such wastes are causing air and water pollution problems. Animal wastes entering surface water supplies may decrease potability, may cause excess aquatic growth, and may destroy their recreational potential. The moving of city dwellers into areas containing feedlots has caused odor to become an eminent problem. Due to economic advantages of commercial fertilizers, land disposal no longer seems to be the answer to animal waste disposal. Also, there are many times of the year when land isn't available and the wastes must be stored. Stored wastes spread on lands often add to odor nuisances. Additionally, there is a limit to the loading rate. Grasses receiving too many nitrates can become toxic to grazing animals. Research has identified techniques that reduce the quantity of wastes that are eroded from feedlots. These include detention ponds and interception terraces. Action programs that have been initiated to implement research findings include cost sharing programs by the Agricultural Stabilization and Conservation Service, educational programs by the extension service, and some loans by the Farmers Home Administration. Alternatives for animal waste disposal that are under study include: (1) processing of animal wastes by heat treating or ensiling and then refeeding them to animals and (2) biological separation of protein from wastes with insects and reclaiming nutrients through harvest of algae. (Merryman-East Central)

4458-B2, C2, D3, E3
THE SYMBIOTIC GROWTH OF ALGAE AND BACTERIA ON SWINE WASTE

F. R. R. Negron
M.S. Thesis, Department of Agricultural Engineering, Purdue University, Dec., 1976, 69 p. 3 fig., 15 tab., 41 ref.

Keywords: Waste treatment, Aerobic conditions, Byproduct recovery, Swine wastes, Detention times, Nitrogen, Refeeding.

This study evaluated the conversion of swine manure into a bacteria and algae biomass. During a preliminary study, it was determined that a symbiotic relation of algae and bacteria could evolve and maintain aerobic conditions with no external addition of oxygen, when the detention time was 6 days. Based on results of that study, a continuous culture experiment was conducted to evaluate the effect of detention time on the symbiotic growth of algae and bacteria. The substrate was swine waste which was diluted to a Kjeldahl nitrogen concentration of 500 mg/1. Detention times of 6 days, 4 days, and 2 days were utilized. There was a significant difference in the production of biomass and treatment efficiency due to detention time. The system was highly efficient in the conservation of nitrogen. The following conclusions were drawn from the study: (1) In order to maximize the production of biomass per unit of substrate consumed, a four day detention time should be used. (2) The greatest reduction in soluble organic matter occurred at the longest detention time of 6 days. (3) A biomass yield of .45 units of volatile suspended solids would be expected from degradation of 1 unit of soluble COD. (4) 1300 mg/1 of high protein biomass was produced at the 4 day detention time. (5) The highest concentration of algae as measured by chlorophyll content was obtained at the longest detention time of 6 days. (6) The system was more aerobic during the 6 day detention time as measured by the oxidation reduction potential. (Merryman-East Central)

4459-A8, B2, B5, C2, E2
STUDIES ON THE USE OF ANIMAL SLURRIES TO MANURE BARLEY 1 -- THE EFFECT OF AGE AND DILUTION OF COW AND PIG SLURRY WHEN APPLIED AT VARIOUS RATES, BOTH BEFORE AND AFTER SOWING

Greenmount Agricultural and Horticultural College, Muckamore, Co. Antrim, Northern Ireland
T. A. Stewart
Record of the Ministry of Agriculture, Northern Ireland, V. 18, No. 2, p. 125-136, 1969. 3 fig., 13 tab., 31 ref.

Keywords: Slurries, Land application, Cattle wastes, Swine wastes, Nitrogen, Fertilizers, Barley, Crop response.

Experiments in 1965 and 1966 assessed the effects of storage period, dilution rate and time of application of cow and pig slurry on barley, grown as a 6th and 7th year cereal crop. Pig slurry gave slightly more grain than did cow slurry. Slurry applied immediately after sowing, gave two cwt per acre more grain than when it was applied to the ploughed surface before cultivations. Storage of slurry for up to three months before applicatioin did not affect yield. The response of seedbed applications of slurry was increased by dilution. The optimum dilution is probably not greater than 1 part slurry: 2 parts water for either type of slurry. Yields were not increased when diluted slurry was applied to the ploughed surface, and indeed were considerably reduced when slurry was applied at a dilution rate of 1:5. The experiments suggest that slurry nitrogen is almost as effective on barley as is inorganic fertiliser nitrogen. (Stewart-Greenmount Agricultural and Horticultural College)

4460-A8, B2, C2, E2
STUDIES ON THE USE OF ANIMAL SLURRIES TO MANURE BARLEY 2 -- THE EFFECT OF AUTUMN, WINTER AND SPRING APPICATIONS OF COW, PIG AND POULTRY SLURRY

Greenmount Agricultural and Horticultural College, Muckamore, Co. Antrim, Northern Ireland
T. A. Stewart
Record of the Ministry of Agriculture, Northern Ireland, V. 18, No. 2, p. 137-142, 1969. 12 tab., 6 ref.

Keywords: Slurries, Cattle wastes, Swine wastes, Poultry wastes, Seasonal applications, Land application, Fertilizers, Crop response, Phosphates.

Experiments in 1966 and 1967 examined the effects of cow, pig and poultry slurry applied in the autumn, winter and spring to barley grown as a 7th or 8th year cereal crop. The slurry was applied to stubble ground and to the ploughed surface at rates supplying 50, 10, and 150 lb total N per acre. Winter and spring applications of slurry gave similar yields which were significantly higher than those from autumn applications. Pig and poultry slurry behaved similarly, outyielding cow slurry, particularly when applied in the winter and spring at the higher rates. Differences between slurry types and rates of application were small at the autumn application, presumably because of nutrient losses through leaching. Yields were not improved by ploughing-in slurry immediately after application when compared with applications made to the ploughed surface. Results from one experiment suggest that supplementation of slurry with inorganic phosphate may be necessary under conditions of low available soil phosphate. (Stewart-Greenmount Agricultural and Horticultural College)

4461-A2, A6, A7, A10, B1, B2, B3, B4, E2, E3, F1
WASTE MANAGEMENT PRACTICES OF WESTERN CATTLE FEEDLOTS

Agricultural Economist, Economic Research Service, Fort Collins, Colorado
C. K. Gee
Waste Management Practices of Western Cattle Feedlots, Paper AE-2, Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture in cooperation with Economics Department, Colorado State University, Jan., 1977. 45 p. 1 fig., 29 tab.

Keywords: Waste management, Western United States, Feedlots, Cattle wastes, Solid wastes, Costs, Waste disposal, Runoff control, Dust control, Insect control, Odor, Noise, Location, Waste storage, Land disposal.

This report summarizes waste management practices of feedlots with over 2,000-head capacity in major feeding areas of 13 western states--Texas, California, Oklahoma, Washington, Oregon, South Dakota, Kansas, Nebraska, New Mexico, Colorado, Montana, Arizona, and Idaho. Management practices for handling solid waste are described, as well as methods to control pollutant factors such as surface water runoff, odors, dust, insects, and noise. The study describes how extensively pollution control techniques are used, as well as the initial capital investment required to implement them and the additional costs incurred through their use. It compares data by capacity of feedlot and by four major regions. (Gee-Colorado State University)

4462-A5, A8, B1, C2, E2
THE SELECTION AND MANAGEMENT OF FEEDLOT SITES AND LAND DISPOSAL OF ANIMAL WASTE IN BOISE VALLEY, IDAHO

Hydrogeologist, Boise State University, Boise, Idaho 83725
L. L. Mink, C. M. Gilmour, S. M. Beck, J. H. Milligan and R. L. Braun
Proceedings of the Third National Ground Water Quality Symposium, Environmental Protection Agency Report EPA-600/9-77-014, June, 1977, p. 55-69. 11 fig., 9 tab., 30 ref.

Keywords: Feedlots, Management, Location, Land disposal, Application rates, Idaho, Chemical properties, Soil profiles, Groundwater pollution.

Environmental effects of feedlot location and related land disposal operations can be minimized if proper knowledge of hazardous conditions are known and appropriate protective steps taken. Common guidelines often do not apply because of differing physical characteristics of local areas. Analyses of various parameters within a soil profile beneath a feedlot revealed none of the chemical constituents present in hig concentrations below the 23-foot depth. In areas where shallow ground water was less than 5 feet from the surface, the ground water was found to be affected by the feedlot. Other hazardous areas in feedlot location are flood-prone areas, areas of surface bedrock, and areas of excessive slope. For land disposal operations, loading rates and frequency of application of feedlot waste should be adjusted in accordance with soil permeability, depth to ground water, and irrigation practices to minimize detrimental effects on groundwater quality. (Mink-Boise State University)

4463.A2, A3, A4, B1
WATER QUALITY AND THE FARM POND

Agriculture Canada Research Station, Lethbridge, Alterta, Canada
J. R. Allan
Canada Agriculture, V. 22, No. 2, p. 3-4, Spring, 1977. 2 fig.

Keywords: Farm ponds, Water quality, Agricultural runoff, Feedlots, Point sources, Non-point sources, Water pollution.

With growing urban populations, there is pressure on agriculture to produce more food on less land. Marginal land that once acted as a buffer between cultivated land and aquatic environments is often now cultivated. Thus, the lakes, ponds and canal systems can now receive increased amounts of nutrients from the drainage of fertilized upland, grazed grassland, the farmyard, feedlot waste drainage and livestock watering. This in turn stimulates excessive aquatic vegetation and deteriorates the quality of water. Control of this depends on managing the level of nutrients reaching the farm pond. This can be done by constructing pond and drainage canals according to guidelines set out by the Prairie Farm Rehabilitation Administration. These include a shelter-belt or tree line with the area between it and the pond being grassed. This helps contribute to the water supply, acts as a biological filter to retain the excess nutrients and prevents soil erosion. The pond or canal must be fenced to keep livestock out. This prevents bank destruction, soil erosion, and phosphorus and nitrogen enrichment of the water by animal wastes. If the pond is kept clean, it can be stocked with fish, or used fór irrigation, swimming, and general farm use. It is very critical that terrestrial weed seeds from plants growing on the canal banks are prevented from entering the water and being spread on fields during irrigation. (Bates-East Central)

4464-A8, B3, B5, C2, E2
CHARACTERIZATION OF AN AGENT IN AQUEOUS EXTRACTS OF BEEF CATTLE MANURE THAT INHIBITS THE GERMINATION OF BARLEY SEEDS

R. G. Bell
Journal of Environmental Quality, V. 6, No. 2, p. 163-164, April-June, 1977. 2 tab., 6 ref.

Keywords: Cattle manure, Feedlots, Land application, Germination, Barley, Polysaccharides, Protein, Aqueous extracts.

A study was conducted to ascertain if aqueous extracts or the polysaccharide or protein fractions of fresh and feedlot-surface manure, which may contain residual digestive secretions, are inhibitory to the germination of barley [*Hordeum vulgare* L.) and, if so, to characterize the phytotoxic agent. Neither the polysaccharide nor the protein fractions inhibited germination. Evidence seemed to indicate that bile compounds at concentrations in excess of 200 ppm in the manure extracts inhibit germination. If high rates of manure application must be used, it would appear reasonable to incorporate the manure in the fall, leaving the microbes time to destroy the toxic bile compounds before seeds are planted the next spring. (Merryman-East Central)

4465-A6, B2, C2, D2, D3
CHEMICAL CONTROL OF HYDROGEN SULFIDE FROM ANAEROBIC SWINE MANURE. II. IRON COMPOUNDS.

Agricultural Engineering Branch, British Columbia Department of Agriculture, Abbotsford, British Columbia, Canada
E. M. Barber and J. B. McQuitty
Canadian Agricultural Engineering, V. 19, No. 1, p. 15-19, June, 1977. 11 fig., 5 tab., 14 ref.

Keywords: Odor control, Swine wastes, Anaerobic conditions, Chemical treatment, Iron compounds, Hydrogen sulfide.

The effectiveness of ionic and metallic iron for controling the evolution of H_2S from anaerobic swine manure was investigated in laboratory and bench-scale trials. The results of these trials indicate that if large dosages of ferrous salts could be attained economically, H_2S evolution could be virtually eliminated. Powdered iron was almost as effective as ferrous iron, however, metallic iron added to manure as rods or pipes was not found to be effective, although severe corrosion of the metal did occur. Ferric iron was not found to be particularly effective, this apparent ineffectiveness perhaps being due to undesirable pH changes caused by excessive application rates. The iron compounds exert their effect on H_2S evolution by precipitating soluble sulfides in the manure solution as insoluble iron sulfide. While the economics of the treatment of manure with iron as an odor control agent are not encouraging, such treatment would appear to be potentially useful in cases where waste liquefaction and organics stabilization are required, such as in anaerobic methane digestion. Further trials are required to study methods for increasing the rate of corrosion of metallic iron in manure solutions. (Copyright 1977 - Canadian Agricultural Engineering)

4466-B2, B3, C2, D1

DEWATERING A SWINE MANURE SLURRY BY EXPRESSION

J. F. Steffe
M.S. Thesis, Department of Agricultural Engineering, Michigan State University, 1976, 77 p. 13 fig., 4 tab., 26 ref.

Keywords: Swine wastes, Slurries, Filtration, Expression, Settling, Separation techniques, Pilot studies.

Expression is a special case of filtration in which a two phase liquid--solid mixture is placed under compression by the movement of retaining walls. The liquid is allowed to escape through perforations in the retaining wall while the solids are held back. Basic information concerning the expression of a swine manure slurry is presented. Swine feces are found to consist of large fibrous solids and fine solids. The fine material may be separated from the fibrous solids by the addition of a dilutant (such as water) and subsequent mixing. Final removal is accomplished by allowing the fibrous solids to settle and conveying the excess liquid (with fines in suspension) away from the settled material. Liquid is easily expressed from the fibrous solids once the fine material has been removed. Expression is a viable method of dewatering swine manure if the fine solids are properly managed. A pilot scale model expression device was constructed to test a design concept for use in a full scale waste system. Model construction was based on the initial expression data and the experience gained in that phase of the work. The pilot scale device received an influent slurry from which the fine solids had been previously removed. Performance of the pilot expression model was promising and the design concept could be used for a full scale expression device. If such a device were added to an existing flush -- lagoon system a 58.8 percent reduction in the quantity of volatile solids going to the lagoon could reasonably be expected. (Steffe- Michigan State University)

4467-A4, A6, A8, B3, C1, C2, D1, E2, E3

EFFECT OF DRYING ON THE LOSSES OF NITROGEN AND TOTAL SOLIDS FROM POULTRY MANURE

B. J. Holmes
Unpublished M.S. Thesis, Cornell University, 1973, 97 p. 12 fig., 7 tab., 56 ref.

Keywords: Poultry manure, Drying, Nitrogen losses, Total solids losses, Moisture content, Sampling, Direct weighing, Temperatures, Recycling, Refeeding, Odor control, Crop response, Land disposal, Water pollution.

The purpose of this study was to investigate the relationship of nitrogen loss as affected by the time to dry manure with unheated air. Laboratory techniques and testing procedures were set up that would yield the most accurate determinations of nitrogen for both "fresh" and "dried" manure samples. Because "direct weighing" was considered the most accurant of 3 techniques tested for determining nitrogen concentration, it was the method utilized in the final testing. Study results indicated the following: (1) Provided that drying through the 30 percent to 20 percent moisture range is not prolonged, nitrogen loss with drying time can be estimated by the following equaton: NL = 77(1 - e.—.0032 x DT = .082). (2) The rate of nitrogen loss was relatively constant for the first 2 weeks of drying time, whereupon it apparently began to decrease. (3) The following table demonstrates how nitrogen loss was affected by drying time:

Drying Time	Nitrogen Loss (percent of Original)
1 day	3
1 week	26-36
2 weeks	45-55
3 weeks	57-67
4 weeks	65-75

(4) Total solids loss was 15-20 percent for a drying time of about 250 hours. However, 40 percent of the total solids could conceivably be lost during a one month drying time. (5) The Ammonia-N produced by microbial decomposition of the manure volatilized from the manure surface into the atmosphere. (6) For the short drying time (up to about 117 hrs) for which a comparison can be made and for the 2 temperatures tested, temperature had little effect on the rate of nitrogen loss. The significance of these findings was examined in relation to short drying time, poultry manure as a feed ingredient for ruminants, odor control, crop production, prolonged drying, land disposal, and manure management to minimize water pollution. (Merryman-East Central)

4468-A4, A8, B2, C2, E2

COMPOSITION AND REACTIONS OF LIQUID MANURE (GULLE), WITH PARTICULAR REFERENCE TO PHOSPHATE: I. ANALYTICAL COMPOSITION AND REACTION WITH POORLY CRYSTALLINE IRON OXIDE (FERRIHYDRITE)

Division of Soils, CSIRO, Private Bag No. 2, Glen Osmond, South Australia 5064
A. W. Fordham and U. Schwertmann
Journal of Environmental Quality, V. 6, No. 2, p. 133-136, April-June, 1977. 6 tab., 20 ref.

Keywords: Gulle, Cattle wastes, Liquid wastes, Land disposal, Soil properties, Soil profiles, Phosphate, Iron oxide, Leaching, Groundwater pollution, Germany.

Samples of gulle (a thin slurry of dung, urine, and water, together with a small amount of bedding straw) of different maturity were collected from 3 sites in West Germany and analyzed for several components, many of them relevant to the behavior of phosphate in both liquid and solid phases. When gulle solutions were shaken with iron oxide, changes of inorganic phosphate concentration were very similar to those observed in comparable model inorganic systems examined at the same time. While inorganic phosphate was sorbed by iron oxide, there was no interference from organic components of gulle and very little organic phosphate was sorbed. In another study, Fordham and Schwertmann determined that uptake by iron oxide from gulle suspensions, in contrast to solutions, invariably led to higher concentrations of phosphate remaining in solution. This was due to capacity of the solid phase to buffer against phosphate losses, by dissolution of mainly inorganic, but partly organic, phosphate salts in the gulle residues. In a 1972 study, Vetter and Klasink observed that the transport of phosphate to a considerable soil depth was probably not due to any lack of reaction between soluble inorganic phosphate in gulle and iron oxide in the soil. The most likely explanation was that phosphate in gulle and iron oxide in the soil. The most likely explanation was that phosphate moved through the highly permeable, sandy soil as a suspension of finely divided inorganic particles, movement being accelerated by the large volumes of liquid applied (up to an equivalent of 26 mm rain). Rapid movement of phosphate in solid form would limit retention of soluble phosphate by soil components such as iron oxide. (Merryman-East Central)

4469-B2, C1, C2

COMPOSITION AND REACTIONS OF LIQUID MANURE (GULLE), WITH PARTICULARLY REFERENCE TO PHOSPHATE: II. SOLID PHASE COMPONENTS

Division of Soils, CSIRO, Private Bag No. 2, Glen Osmond, South Australia 5064
A. W. Fordham and U. Schwertmann
Journal of Environmental Quality, V. 6, No. 2, p. 136-140, April-June, 1977. 2 tab., 16 ref.

Keywords: Gulle, Cattle wastes, Liquid wastes, Chemical properties, Struvite, Trimagnesium phosphate, Calcium phosphates, Solubility, Germany.

Gulle samples from 3 sites in West Germany were examined to determine the nature of the solid phase and its equilibria with dissolved components, particularly inorganic ones. Gulle was found to be a complex mixture containing a number of solid components, all at or near equilibrium with each other and reacting quite rapidly to any changes of solution composition. Among the components detected were: struvite, trimagnesium phosphate, octacalcium phosphate, and dicalcium phosphate. Distribution of components between phases (gaseous included) can be expected to depend very closely on conditions imposed upon the system both before and after its applicatin to the field. For example, pH values of soils to which gulle is applied will generally be below those of gulle itself, so that some dissolution of inorganic and organic salts from the solid phase of gulle can be expected for this reason alone. (Merryman-East Central)

4470-B2, B4, C2, E2

COMPOSITION AND REACTIONS OF LIQUID MANURE (GULLE), WITH PARTICULAR REFERENCE TO PHOSPHATE: III. pH-BUFFERING CAPACITY AND ORGANIC COMPONENTS

Division of Soils, CSIRO, Private Bag No. 2, Glen Osmond, South Australia 5064
A. W. Fordham and U. Schwertmann
Journal of Environmental Quality, V. 6, No. 2, p. 140-144, April-June, 1977. 1 fig., 14 ref.

Keywords: Gulle, Liquid wastes, Cattle wastes, Organic compounds, Chemical properties, Amino acids, Tyrosine, Glutamic acid, Histidine, Waste storage, pH-buffering capacity, Germany.

Efforts were made to detect organic components which might affect phosphate distribution in gulle, both before and after application to soils. pH titrations of gulle samples revealed differences in composition related to origin, age, and storage conditions prior to collection. Buffering capacities depended partly on ammonium bicarbonate content. Organic compounds in solution and solid phases buffered in the lower pH ranges. Acetate, oxalate, citrate, tartrate, lactate, adipate, ascorbate, succinate, hippurate, pyrophosphate, and urea were not detected in gulle solutions. Positive evidence was obtained for tyrosine but not tryptophan. Glutamic acid and histidine were probably present. In the light of pH titrations, more organic compounds may have been detected if samples had been examined immediately after collection. There were no simple carboxylic acid anoins of the type that inhibit phosphate uptake by iron oxides. (Merryman-East Central)

4471-B2, B3, B4, B5, E2

AWARD FOR NEBRASKAN

Anonymous
Feedlot Management, V. 18, No. 9, p. 10, Sept., 1976.

Keywords: Feedlots, Waste management, Debris basins, Holding ponds, Land disposal, Liquid wastes, Solids wastes.

Lewis Feedlot, Inc. installed a $150,000 waste management system which consisted of debris basins for collecting solid wastes and holding ponds for containing liquid runoff from the lots. After collection and settling, the solid wastes are applied to cropland as fertilizer and the liquid are used for irrigation. Benefits of the system have been: reduction in amount of commercial fertilizer used, prevention of waste runoff into the Wood River, and improvements in drainage, cleanliness, insect and odor problems. The J. L. Higgins Award was given to Dwayne Lewis, owner of the feedlot, in recognition of his outstanding contribution -- above and beyond normal compliance with regulations -- in the field of environmental protection. (Merryman-East Central)

4472-B2, C2, D3, E3

BIO-GAS PLANT: DESIGNS WITH SPECIFICATIONS

Gobar Gas Research Station, Autmal, Etawah, (U.P.), India
R. B. Singh
Bio-gas Plant: Designs with Specifications, Gobar Gas Research Station, Ajitmal Etawah (U.P.), India, 1973, 49 p.

Keywords: Bio-gas plants, Anaerobic digesters, Methane, Recycling, Design, Specifications, India

A methane digester should be big enough to handle the quantity of raw material available. If the digester is too small, it has to work under organic overload, resulting in poor digestion, low gas production, and perhaps even complete stoppage. Location should be convenient so that wastes and water do not have to be transported very far. Types of artificial heating arrangements must also be planned before starting digester installation. This publication contains drawings with specifications for 2 different types and sizes of bio-gas plants suitable for cold and temperate climatic areas. (Merryman-East Central)

4473-B3, C1, C2, D3, E3, F1

FEEDING POULTRY LITTER

Anonymous
Calf News, V. 15, No. 9, p. 34, 53, Sept., 1977. 3 fig.

Keywords: Refeeding, Ensiling, Poultry excreta, Litter, Cattle, Diets, Economics.

Sam B. Hay, Jr., president of Piedmont Silo Company in Covington, Georgia, has placed several producers in the Southeast on poultry excreta feeding programs and he prefers, in addition to ensiling, that a portable mixer/feeder, such as the Oswalt Ensilmixer, be the pivot point of the feeding system. This is because mixing and feeding or mixing and ensiling can be done with a minimum of labor and machinery. Hay says that rations for finishing programs must be based on careful research and analysis. Hay feels that an optimum mix of excreta, corn and corn silage is best for finishing programs. However, dry blood cows can be maintained on 90 percent poultry excreta (ensiled) and 10 percent roughage such as corn stalks. Regardless of the ration and the purpose of it, properly ensiled poultry excreta is the only protein supplement that should be needed. Poultry excreta can best be ensiled by mixing it with some fiber or grain and placing it in a sealed bottom unloading concrete silo. The sealed characteristics of the silo protect the nutrient composition from weather, air and temperature changes. (Merryman-East Central)

4474-A2, A4, A5, B1, B5, C2, E2, F1, F2

ENVIRONMENTAL AND ECONOMIC IMPACT OF NUTRIENT MANAGEMENT ON THE NEW YORK DAIRY FARM

Department of Agronomy, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, New York
D. R. Coote, D. A. Haith, and P. J. Zwerman
Search: Agriculture, V. 5, No. 5, p. 1-27, 1975. 10 fig., 9 tab., 53 ref.

Keywords: Mathematical models, New York, Dairy industry, Regulation, Economics, Land application, Agricultural runoff, Nitrogen, Water pollution, Groundwater pollution, Herd densities.

The two-step modelling procedure was applied to selected townships in West Jefferson County and Southwest Oneida County in New York. These regions are significant dairy areas and represent wide variations in soils and topography. The mathematical model was used for 2 types of analyses. The first was identification of farm management policies that maximize net revenue and attendent environmental effects as a function of farming intensity (cows/acre number of cows divided by total farm area). The second analysis imposed hypothetical manure disposal and fertilizer application regulations on the farmer and determined the income-maximizing management decisions and environmental effects associated with such regulations. It was found that a model that uses concepts proven in large- and small-scale studies and that enables complex accounting and mathematical accuracy, can be a valuable tool in the study of nutrient losses from agricultural land and measures to control them. The general conclusions drawn from mathematical modeling in this particular instance were: (1) Use of dairy manure by cropping rotations of the dairy farm is an economically optimal nutrient management policy. (2) Compatability of environmental and economic objectives diminishes as farming intensity increases. (3) Although potential nitrogen losses can be very significant as farming intensity reaches maximum levels, soluble nitrogen loss in runoff never exceeded 2 lb./acre for the 2 study areas. (4) The greatest losses of nutrients to surface water were associated with soil erosion. (5) Increasing cow/land ratios increases the loss of nutrients to surface and groundwater from farms with poor soils in 2 ways: (a) by increasing the proportion of land cultivated for feed requirements; (b) by increasing quantities of manure to be disposed of. (6) The hypothetical controls exert their greatest influence over the dairy farms by reducing the acreage of land available for manure disposal. (7) At herd densities of less than 0.5 cow per acre, it appears possible to meet the requirements of limited manure disposal control without any significant reduction in farm income. (8) Legislation requiring manure disposal only by use in a crop production program may stimulate an increase in the area of cultivated land. If application rates are tied to crop yields, this increase is most likely to occur on farms with poor soils. (9) It is possible to meet control requirements by changing cropping practices. (10) Imposing high level of regulatory controls on manure and fertilizer management could significantly reduce potential nutrient losses from New York State dairy farms, but only at a substantial cost in reduced farm revenues. (Merryman-East Central)

4475-A11, B1, E3

EFFECTS ON CHICK GROWTH OF ADDING VARIOUS NON-PROTEIN NITROGEN SOURCES OR DRIED AUTOCLAVED POULTRY MANURE TO DIETS CONTAINING CRYSTALLINE ESSENTIAL AMINO ACIDS

Agricultural Research Council's Poultry Research Centre, King's Buildings, West Mains Road, Edinburgh EH9 3FS, Scotland
D. J. W. Lee and R. Blair
British Poultry Science, V. 13, p. 243-249, 1972. 3 tab., 13 ref.

Keywords: Poultry, Diets, Refeeding, Dried autoclaved poultry manure, Crystalline essential amino acids, Feed supplements, Performance.

Female broiler chicks were offered semi-purified diets containing crystalline essential amino acids, including proline, supplemented with various nitrogen sources. Individual final body weights, food consumption and food conversion efficiencies (FCE) were measured. In the first experiment 70 1-d-old chicks were given one of seven diets for 21 d; basal (IA) or basal plus: 12 percent L-glutamic acid (IB), 17.05 percent monoammonium citrate (TAC) (IE), 2.45 percent urea (IF) or 4.05 percent triammonium phosphate and 12.56 percent calcium lactate (IG). Using body weight at 21 d and FCE as measures of the effectiveness of the various nitrogen sources the orders were IE (171 g), IB (154 g) > ID (131 g), IG (123 g), IF (118 g) > basal (89 g) > IC (66 g), ($P < 0.05$) and IB (0.456), IE (0.420) > IG (0.346), IF (0.329), ID (0.319) > basal (0.269) > IC (0.192), ($P < 0.05$), respectively. In the second experiment 70 7-d-old chicks were offered one of seven diets for 14 d; basal (2A) or basal plus 12 percent L-glutamic acid (2B), 8.0 percent L-glutamic acid and 2.21 percent TAC (2C), 4.0 percent L-glutamic acid and 4.42 percent TAC (2D), 6.61 percent TAC (2E), 3.43 percent uric acid (2F) or 20.09 percent dried autoclaved poultry manure (2G). When the final body weights at 21 d and FCE were placed into a rank order, the degrees of effectiveness were: 2C (250 g), 2B (245 g), 2D (244 g), 2G (240 g) > 2E (206 g) > basal (165 g), 2F (150 g) ($P < 0.05$) and 2B (0.471), 2G (0.451), 2C (0.445), 2D (0.436) > 2E (0.399) > basal (0.314) > 2F (0.234) ($P < 0.05$), respectively. The results for diets 2B, 2C, 2D and 2E appear to indicate that 4 percent glutamic acid is required for maximal chick growth with these crystalline amino acid diets. (Copyright 1972-British Poultry Science)

4476-A6, B1, D2
FEEDLOT ODOR INTENSITY

Anonymous
Confinement, V. 2, No. 8, p. 14, Sept., 1977.

Keywords: Odor, Feedlots, Cattle, Texas, Scentometer readings, Odor control, Calcium bentonite.

In a Texas Agricultural Experiment Station study, odor intensities measured at 2 Texas cattle feedlots ranged from 1.5 to 170 dilutions to threshold (DT), which covers the measurement range of the Barnebey-Cheney Scentometer. The average odor reading at the surface of a 4000-head feedlot was determined to be 31 DT. The runoff settling basin and retention pond averaged 68 and 46 DT. Because odor intensities were diluted to 1.5 to 2 DT within 1250 to 1650 ft. downwind of the feedlot, adequate separation distance appears to be an effective means of reducing measurable odor levels downwind from a feedlot. Calcium bentonite as a ration ingredient may have some benefit in reducing odors from a cattle feedlot and enhancing cattle performance during the first 21 days of feeding. (Merryman-East Central)

4477-B1, E1, F2
FEEDLOT PAYS PENALTY

Anonymous
Feedlot Management, V. 18, No. 9, p. 10, 16, Sept., 1976.

Keywords: Water pollution, Regulation, Feedlots, Iowa, Pollution control.

Two complaints that an Iowa feedlot owner was discharging pollutants without a permit and that he was violating an administrative order to file for a discharge permit resulted in a $5,000 fine, the largest civil penalty ruled against a feedlot owner since the initiation of the Environmental Protection Agency regulations controlling the pollution of public waterways. The penalty came from a settlement which pre-empted a civil trial. In addition to the $5,000 penalty, the Iowa feeder is still required to take steps to prevent discharge of pollutants from his feedlot into nearby Aahton creek. (Merryman-East Central)

4478-A6, A7, A8, A11, B2, B5, E2
THE HANDLING, TREATMENT, AND DISPOSAL OF FARM WASTES -- APPLICATION OF FARM SLURRIES TO AGRICULTURAL LAND

Department of Agricultural Engineering, The University of Newcastle upon Tyne

K. A. Pollock
The Agricultural Engineer, V. 28, No. 2, p. 67-71, Summer, 1973. 2 fig., 5 tab., 19 ref.

Keywords: Livestock wastes, Slurries, Land spreading, Trafficability, Crop damage, Animal health, Soil damage, Odor, Air pollution, Fertilizers.

The following constraints affect land spreading of livestock waste slurries: trafficability, crop damage, animal health, soil damage, and air pollution. While such wastes have soil fertilizer and soil amendment value, they must be applied after careful planning. The following principles should result in safe and cheap disposal which may be continued indefinitely without fear of agricultural or environmental deterioration: (1) Avoid unnecessary dilution and contamination, so that handling may be simplified, and manurial content predicted. (2) In order to minimize water pollution, avoid spreading on sloping or saturated land. (3) Avoid spreading on unstable soil, or with large droplets which may damage soil structure. (4) Avoid spreading odorous slurry frequently, or with an astomising jet or under windy conditions, wherever smell nuisance may arise. Restrict spreading to the growing season, when the soil is generally unsaturated, and restrict spreading rate to leave the soil unsaturated. (6) Restrict spreading rates to a maximum of 12.5 mm/dressing, to avoid a solid mat accumulating on the surface. (7) Restrict spreading rate, so as to utilize all the available nutrients, in the season of application. (Merryman-East Central)

4479-B1, F1
HOUSING HINTS

Anonymous
Feedlot Management, V. 19, No. 2, p. 10, Feb., 1977.

Keywords: Feedlots, Housing, Midwestern United States, Open lots, Cattle, Management, Economics.

Five management systems were examined for space allowance per head and estimated facility investment per head. They were: cold slot, warm slot, conventional, manure scrape, and open lot. For the Midwest, the open lot with mound and windbreak fence seems to work best. The following reasons are given: (1) Lowest capital investment, (2) Low cost expansion possibilities, (3) Use in conjunction with a confinement facility, (4) More space per head than other systems, (5) Less manure recovery compared to the other systems. When building the open lot, the following recommendations are made: (1) 250 sq. ft./head, (2) Lot, mound and windbreak fence oriented at a right angle to the prevailing winds, (3) Snow removal must be considered and, (4) Lot fences should be high enough to prevent animals from escaping during a snowstorm. (Merryman-East Central)

4480-A2, A6, B1
KEEP IT DRY

Anonymous
Feedlot Management, V. 18, No. 10, p. 18, Oct., 1976.

Keywords: Feedlots, Texas, Odor control, Stocking rates, Agricultural runoff, Holding ponds, Manure pack, Cleaning, Pumpdown.

J. M. Sweeten of Texas A & M University suggests that moisture is the chief cause of odor intensities that measure 17 at Texas feedlots. Sweeten suggests the following for feedlot odor reduction: (1) Keep manure as dry as possible as much of the time as possible. Control stocking rates. Maintain good pen drainage. Maintain watering facilities. Keep manure solids out of runoff holding ponds. (2) Keep a minimum quantity of manure and wastewater on hand. This involves frequent collection of loose surface manure, maintainance of a firm manure pack just above the soil surface, frequent cleaning of drainage channels and solids settling basins, and rapid pumpdown of runoff retention ponds. (Merryman-East Central)

4481-A8, B5, C2, E2
NUTRIENT CONTENT OF SORGHUM LEAVES AND GRAIN AS INFLUENCED BY LONG-TERM CROP ROTATION AND FERTILIZER TREATMENT

Soil and Crop Sciences Department, Texas A&M University, College Station, Texas
H. Brawand and L. R. Hossner
Agronomy Journal, V. 68, No. 2, p. 277-280, 1976. 1 fig., 6 tab., 10 ref.

Keywords: Crop rotation, Fertilizers, Land application, Crop response, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium.

The main objective of this investigation was quantitative delineation of long-term fertilizer and crop rotation influence on concentration and relationships on N, P, K, Ca, and Mg in sorghum leaves and grain. Row crops were fertilized at planting, while manure was applied in late fall in a single treatment. Operational for over 20 years, fertilization amounting to 45 kg N/ha and 20 kg P/ha was applied each season. Fertilizer levels of 89 N, 39 P; 134 N, 59 P; and 179 N, 78 P, in kg/ha were introduced in 1971. Granular and liquid fertilizer sources were utilized. Standard regional soil and crop management operations were followed in the field plots of all three replications. Except for some selection positive influence on sorghum leaf N, leaf P and leaf K, the rotational effect on leaf composition was considered inconclusive. Crop rotation did generally result in larger grain production for both fertilized and unfertilized sorghum. Levels of leaf N, leaf P, leaf K, and leaf Ca were mostly higher in sorghum plants receiving fertilizer. Fertilizer increased grain protein percentage and grain yield. (Merryman-East Central)

4482-A5, A8, C2, C3
NUTRIENT, BACTERIAL, AND VIRUS CONTROL AS RELATED TO GROUND-WATER CONTAMINATION

Ground Water Research Branch, Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma 74820
J. F. McNabb, W. J. Dunlap, and J. W. Keeley
Environmental Protection Agency Report EPA-600/8-77-010, July, 1977, 18 p. 2 fig., 1 tab., 9 ref.

Keywords: Groundwater pollution, Chemical properties, Biological properties, Nutrients, Bacteria, Viruses, Phosphorus, Pollutants, Nitrogen.

A general introduction provides something of the history of groundwater, its present use, and the means by which it can become contaminated. A priority listing of sources of ground-water contamination is presented for four geographical areas of the United States. Phosphorus is discussed in terms of its fate in soil systems. The fate of organic and inorganic nitrogen compounds is also discussed giving consideration to sorption and biological utilization and degradation. Criteria important to the survival and transport of bacteria and viruses is presented along with information concerning indicator organisms in the subsurface environment. (McNabb-Robert S. Kerr Environmental Research Laboratory)

4483-A8, B3, B5, C2, D1, D2, E2

PHOSPHORUS FERTILIZER AS A BY-PRODUCT OF ENERGY PRODUCTION FROM AGRICULTURAL WASTES

Department of Soil Science, University of California, Davis, California
R. S. Siegel, J. Rubin, A. A. R. Hafez, and P. R. Stout
Journal of Environmental Quality, V. 6, No. 2, p. 116-120, April-June, 1977. 4 tab., 12 ref.

Keywords: Animal wastes, Fertilizers, Ash, Land application, Crop response, Corn, Phosphorus, Acidification.

The potential phosphorus fertilizer value of ash left by the combustion of animal manures and agricultural crop residues was examined. Three separate greenhouse pot experiments were conducted using animal manure ash (experiments 1 and 2) and crop residue ash (experiment 3) as sources of phosphorus for corn grown in a phosphorus-deficient Aiken loam soil. Variables included type of ash, rates of phosphorus application, and degree of acidification of the ash. Yields from pots treated with ash acidified at 50 percent of its base equivalent were slightly less than those of 100 percent acidification. (Merryman-East Central)

4484-A6, B1, F2

ODOR COMPLAINTS

Anonymous
Feedlot Management, V. 19, No. 4, April, 1977.

Keywords: Odor, Feedlots, Regulation, Texas, Nuisance suits.

Odor regulations are being studied by the Texas Air Control Board in order to determine an easier, more reasonable way to perfect the present expensive procedures established under the nuisance provision of the Texas Clean Air Act. John Sweeten, Texas agricultural engineer, cites the following points to be considered in filing a valid odor complaint: (1) Odor frequency from the alleged source. (2) Duration of the odor. The plaintiff in the complaint should keep valid records of the offense. (3) Odor intensity. This factor should be scientifically established by chemical or organoleptic measurement of the average and peak odor intensities. (4) Odor offensiveness. This should be determined by a qualified panel. (Merryman-East Central)

4485-B3

PEN CLEANING ISN'T CHEAP

T. Grandin
Beef, V. 14, No. 1, p. 26-28, Sept., 1977. 1 fig., 2 tab.

Keywords: Feedlots, Manure, Cleaning, Efficiency, Costs, Management.

A study was conducted at 4 Texas feedlots with capacities of 28,000 to 100,000 head by John Sweeten, Donald Reddell, and Calvin Parnell of Texas A & M University. Study objectives were to determine the costs and efficiency of different phases of pen cleaning. The study determined the optimum number of hauling trucks, loader operator efficiency, machinery efficiency and relative energy consumption. Observers were stationed in pens during regular feedlot cleaning times to keep accurate records of the time required for the various pen cleaning activities. One of the most important findings was that the surface of the hard ground should be broken up before using a loader. Plowing and loosening the surface with a chisel plow or a rototiller greatly improved efficiency and lowered costs. Then an elevating scraper or a wheel loader could be used for collecting and stacking the manure. It was also found that a well trained operator can save money because he can load twice as much manure into a truck as a poor one. Tips are given for evaluating loader operators. It was determined that for a 100,000 head feedlot, where trucks were owned, a fleet of 5 was the best in terms of overall cost (on a per ton basis). Five trucks will give a 12 percent lower cost than a fleet of 3 trucks. (Merryman-East Central)

4486-A11, A13, B1

MORE ON SHEEP FLOORING

Anonymous
Confinement, V. 2, No. 7, p. 6, July-Aug., 1977.

Keywords: Sheep, Management, Flooring, Cleaning ability, Animal mobility, Injuries, Aesthetics.

Preliminary data are presented concerning the suitability of various types of slotted flooring for sheep. Evaluation of the floors was based on cleaning ability, effects on animal mobility, injuries, and appearance. Observations to date indicate that diet has a major influence on the cleaning ability of some floors. Aluminum floors cleaned well when used by lambs receiving a high haylage diet. The high-profile aluminum slat with the serrated surface and the low-profile aluminum slat with a ribbed surface both accumulated objectionable amounts of waste when used by lambs receiving more concentrate in their diets. The aluminum grid floor accumulated some waste, but cleaned well under the conditions that prevailed. When a heavy accumulation of wastes was removed from the ribbed floor, considerable pitting and oxidation were noticed. Less damage was noted on the serrated floor and none was apparent on the grid floor. The 3½''-wide aluminum slats did not clean adequately. The serrated surface provided poor footing. The grid floor cleaned relatively well, provided good footing, and may be a product to consider for sheep flooring. #9 Safe-T-Mesh with 3/4 inch openings was used in turf-grass feeding work and it cleaned best of all. Lambs moved well with practically no slippage. Safe-T-Mesh is one of the cheaper flooring materials, but requires more framing for support. Stainless-steel slats provided excellent footing for the lambs. Diet influenced cleaning ability, but under most conditions it cleaned well when animal concentrations were near optimum (4 sq ft/lamb). Plastic slats provided goot footing. 5'' plastic slats did not clean adequately. This study will continue with animals of different sizes being fed a variety of diets under varying weather conditions. (Merryman-East Central)

4487-B2, C1, C2, D3, E3

BIOLOGICAL ENERGY RECOVERY USING DAIRY COW WASTE

Environmental Engineer GAI Assocs., Pittsburgh, Pennsylvania
G. M. Patelunas and R. W. Regan
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, V. 103, No. EE5, p. 851-861, Oct., 1977. 3 fig., 4 tab., 14 ref.

Keywords: Anaerobic digestion, Dairy wastes, Liquid wastes, Loading rates, Design, Gas production, Energy.

Anaerobic digestion of dairy manure diluted to a concentration of 7.6 percent of TS was successful at loading rates of 0.14 lb VS/cu ft/day-0.56 lb VS/cu ft of digester capacity/day (2.3 kg/m^3 /day-9.2 kg/m^3 /day). The corresponding SRT values ranged from 7.5 days-30 days. Calculated heat balances indicate winter operation is the critical time for which the system must be economical. High loading rates with corresponding short SRT values must be used in a system designed specifically for energy recovery. The maximum ERP conditions for a 60-cow herd provided an estimated energy production and surplus of 1,515,000 Btu/day and 722,000 Btu/day (383,000 kg.cal/day and 180,000 kg.cal/day), respectively. (Copyright 1977-Journal of the Environmental Engineering Division, Proceedings of the ASCE)

4488-B3, C2, D1, E3

RUMINANTS AND PIGS ARE THE BEST USERS

R. Blair
Poultry World, V. 20, No. 27, p. 21-22, Dec., 1973. 5 tab.

Keywords: Refeeding, Dried poultry manure, Ruminants, Cattle, Sheep, Swine, Digestibility, Crude protein, Energy, Nitrogen.

Dried poultry manure (DPM) is the most suitable of all processed farm wastes for refeeding because of its nitrogen content and because of its digestibility. DPM should contain at least 25 percent crude protein to be of value as a feedstuff. This means that the waste should be collected and dried as soon as possible, preventing fermentation which robs the waste of much of its nutrient value. The energy value of DPM has been estimated to be about 35 percent starch equivalent, with dried poultry litter being about 30 percent. DPM can play an important role in keeping down feed costs and has been used successfully in feed trials for beef cattle, dairy cattle, and sheep. A benefit in feeding poultry wastes to beef cattle is that further supplementation of the rations with minerals is probably unnecessary. There is only limited information available on the feeding of poultry manure to pigs, but what little there is, is favorable. Results of 1 study indicated that pigs up to 75 lb. liveweight should not be fed more than 20 percent, but after this stage it was claimed that a 45 percent inclusion rate was possible. (Rowe-East Central)

4489-A8, B3, B5, C2, E2

EXPERIMENTS MADE ON STACKYARD FIELD, WOBURN, 1876-1974. I. HISTORY OF THE FIELD, DETAILS OF THE CROPPING AND MANURING AND THE YIELDS IN THE CONTINUOUS WHEAT AND BARLEY EXPERIMENTS

Rothamsted Experiment Station, Harpenden, Hertshire A15 2JQ, England 1, United Kingdom.
A. E. Johnston
Rothamsted Experiment Station Report for 1974, Part 2, p. 29-44, 1975. 1 fig., 8 tab., 26 ref.

Keywords: Farmyard manure, Fertilizers, Crop response, Wheat, Barley, Phosphorus, Potassium, Nitrogen, Land application.

1. Experiments made on Stackyard Field, Woburn, between 1877 and 1974 are given together with details of the cropping, manuring and yields in the Continuous Wheat and Barley experiments. 2. Yields of wheat and barley in the Continuous experiments showed responses to N and PK in the early years of the experiment. However, during the course of the experiment the acidity of the soil increased, especially quickly where ammonium sulphate was used. The soils became so acid that the yields of both wheat and barley diminished and as yields decreased the amount of weeds on the plots increased. Chalking improved cereal yields. 3. After 1926 no further dressings of P and K were given either as fertilisers or as FYM in the Continuous Wheat and Barley experiments. When a test of amounts of N was made between 1943 and 1954 both wheat and barley responded to N and there was a benefit from the PK residues accumulated between 1877 and 1926. 4. Dressings of chalk were given on the Continuous Wheat and Barley experiments between 1955 and 1957 to bring the surface soils of all plots to pH 6. During 1959-60 winter wheat and spring barley given basal N fertiliser were grown side by side on all plots of both experiments. Wheat yielded better on the barley experiment that on the wheat experiment, barley better on the wheat experiment than on the barley experiment. Whether this was due to differences in soil fertility or disease on the two experiments is not known. 5. Estimates of the amounts of P and K removed in the crops are given. (Johnston-Rothamsted Experiment Station)

4490-A8, B3, B5, C2, E2

EXPERIMENTS MADE ON STACKYARD FIELD, WOBURN, 1876-1974. II. EFFECTS OF TREATMENTS ON SOIL pH, P AND K IN THE CONTINUOUS WHEAT AND BARLEY EXPERIMENTS

Rothamsted Experiment Station, Herpenden, Hertshire, A15 2JQ, England 1, United Kingdom
A. E. Johnston and M. Chater
Rothamsted Experiment Station Report for 1974, Part 2, p. 45-60, 1975. 3 fig., 8 tab., 21 ref.

Keywords: Land application, Manure, Lime, Phosphorus, Potassium, pH, Chalk, Soil properties, Acidity.

1. The reasons for and the historical background to the introduction of liming tests are given and comparison is made with the introduction of similar tests at Rothamsted. 2. The effects of the manurial treatments 1877-1926 and liming treatments in 1898-1924 and again in 1955-57 on soil pH, total and bicarbonate soluble P and total and exchangeable K are discussed. 3. The relationship between pH measured in water and in $CaC1_2$ using a glass electrode is given as is the relationship between pH $CaC1_2$ by glass electrode and pH water using a quinhydrone electrode. 4. All amounts of lime applied between 1898 and 1924 increased soil pH as determined in 1927; the larger amounts of lime increased soil pH most. 5. Chalk applied between 1955 and 1957 was intended to bring surface soil pH water to about 6. This pH value was attained by 1959 but amounts of chalk applied were larger than those indicated by the laboratory determination of the lime requirements. The results suggested a field factor of 1.4. The need to use a field factor is discussed. 6. All soils became more acid during 1877-1954. Those treated with ammonium sulphate, 1877-1926, became most acid soonest but even unmanured soils and those which were fallowed became more acid during the course of the experiment. These results indicate the need for liming on this light soil if pH is not to decrease under any manurial treatment. Liming treatments during 1954-59 were successful in increasing the pH water of the surface soil to 6 without any overliming. 7. The P balance (additions minus losses) in the soil during 1877 1926 was related to the total P in the surface soil in 1956. Total P determined by fusion with Na_2Co_3 gave slightly larger values than those got by digestion with perchloric acid. The relationship between the results by the two methods on these soils compared favourably with that reported by Mattingly (1970). 8. When bicarbonate soluble P was expressed as a fraction of the total P it was shown that increasing acidity had increased soluble P. 9. For residues of P applied to soil the increase in bicarbonate soluble P can be expressed as a percentage of the increase in total soil P, the solubility of the P residues. When this was done for soils taken in 1956 the solubility of P dressings applied from 1877-1926 was found to be 12-14 percent for P residues from superphosphate and 6-8 percent for residues from FYM. 10. There is little information about K residues in this experiment. Soils which received most K during 1877-1926 had most exchangeable K in 1956. (Johnston - Rothamsted Experiment Station)

4491-A8, B3, B5, C2, E2

EXPERIMENTS MADE ON STACKYARD FIELD, WOBURN, 1876-1974. III. EFFECTS OF NPK FERTILISERS AND FARMYARD MANURE ON SOIL CARBON, NITROGEN AND ORGANIC PHOSPHORUS

G. E. G. Mattingly, M. Chater, and A. E. Johnston
Rothamsted Experiment Station Report for 1974, Part 2, p. 61-78, 1975. 3 fig., 6 tab., 21 ref.

Keywords: Farmyard manure, Fertilizers, Land application, Carbon, Nitrogen, Phosphorus, Soil properties, Crop response.

1. This paper describes changes, from 1889-1959, in the C, N, and organic P in surface soils (0-23 cm) taken from the Continuous Wheat and Barley experiments on Stackyard Field Woburn, and subsequent changes, from 1959-72, in soil C and N in some of the soils. Changes in soil C in soils cropped continuously with wheat or barley, or occasionally fallowed, from 1876-1972 are compared with changes in other soils on Stackyard Field cropped in rotations. 2. Soil carbon and nitrogen decreased from 1.49 percent C and 0.156 percent N in 1876 to about 0.82 percent C and 0.094 percent N in the Continuous Wheat experiment and to about 0.64 percent C and 0.084 percent N in the Continuous Barley experiment in 1959 on plots given inorganic fertilisers or none. Inorganic fertilisers (NPKNaMg), applied from 1877-1926 did not increase the carbon and nitrogen contents of the soils more than no fertilisers or nitrogen only, probably because crop yields were small and the extra amounts of organic matter returned to the soil as roots and stubble were negligible. Farmyard manure (about 17.6 t/ha each year from 1877-1926) increased soil carbon and nitrogen in the surface soils by about 0.14 percent C and 0.013 percent N in 1959 and these residues are equivalent to about 7 percent and 8 percent respectively of the amounts of carbon and nitrogen applied in the manure. A further 2-3 percent of the carbon applied was recovered in the sub-soil (23-45 cm) in 1959. 3. Methods of sampling soils changed between 1927 and 1932. The soils sampled in 1932 contained 0.91 times as much total P as soils sampled in 1927, probably because the 1927 sample contained a disproportionately large amount of surface soil. 4. Organic P decreased between 1888-1959 on soils given no phosphorus fertilisers by about 30 mg P/kg soil and these soils lost, in 71 years, about 12 percent of the total organic P they contained in 1888. Organic P remained almost constant from 1888-1927 in soils given superphosphate but decreased by about 15 mg P/kg soil between 1927-59 when no superphosphate but decreased by about 15 mg P/kg soil between 1927-1959 when no superphosphate was applied. Organic P in the soils increased by about 30 mg P/kg between 1888-1927 on plots given farmyard manure and decreased by about 35 mg P/kg soil between 1927-59 when no more farmyard manure was applied. About 27 percent of the organic phosphorus applied in farmyard manure between 1877-1926 remained in the surface soil (0-23 cm) in 1959. The amounts of organic P mineralised each year in these soils ranged from 1.5-3.5 kg P/ha. 5. Sections of Stackyard Field (Series C and D) were cropped in a four-course rotation from 1877-1936. Soil carbon decreased less in these soils (-0.11 percent C) than in the Continuous Wheat and Barley experiments (-0.32 percent C) between 1876-98 but more (-32 percent C) than in the continuous cereal experiments (-0.19 percent C) between 1898-1932. 6. Water erosion during the past 20 years has probably increased losses of soil carbon and nitrogen which are still decreasing on all plots of the Classical Wheat and Barley experiments. (Mattingly-Rothamsted Experiment Station; Merryman-ed)

4492-B1
COMPARISON OF FEEDLOT MANURE COLLECTION MACHINERY

Anonymous
Agricultural Engineering Newsletter, V. 1, No. 10, p. 1, Dec., 1975. 1 tab.

Keywords: Manure collection, Equipment, Elevating scraper, Wheel loader.

From preliminary analysis of data from time-motion studies conducted at four Panhandle feedlots last summer, John Sweeton has indicated that the elevating scraper (or paddle scraper) is up to 50 percent more efficient in feedlot manure collection than the most commonly-used wheel loader (or front loader). Based on the time required to stack manure in the pens, the elevating scraper collected an average of 175 tons/hr, while wheel loaders at these feedlots operating under various conditions could collect only 123 tons/hr. Data for each feedlot, together with additional steps not included in the productivity figures are present in tabular form. (Bates-East Central)

4493-A8, B2, B5, C2, E2
SWINE MANURE FOR FERTILIZER -- RESEARCH REVIEW

Anonymous
Agricultural Engineering Newsletter, V. 1, No. 10, p. 1-2, Dec., 1975.

Keywords: Swine wastes, Liquid wastes, Aerobic conditions, Anaerobic conditions, Land application, Crop response, Soil properties, Ryegrass, Clover, Nitrogen, Salts, Coastal bermudagrass.

Research has shown swine manure to be a satisfactory source of plant nutrients. At Purdue, corn yields were significantly higher (9 to 20 percent on sandy loam and 39 to 116 percent on silty clay loam) on plots fertilized with anaerobic and aerobic liquid swine manure (0.3 percent N) than on unfertilized (control) plots. Peak yields occurred at application rates of 10,700 and 16,000 gals. of liquid swine manure/acre, for the sandy loam and silty clay loam soils, respectively. As compared to optimum rates of commercial fertilizer, liquid swine manure treatments increased corn yields up to 10 percent on the coarser soil, but responses from manure varied from 4 percent larger to 30 percent smaller on silty clay loam. Soil physical and chemical properties were not adversely affected even at the highest application rate and at salt dietary levels as high as 0.5 percent. British research showed higher ryegrass and clover yields resulting from swine manure slurry applications as compared to unfertilized plots. Plots receiving 100 lbs. N/acre in a 50/50 feces-urine mixture produced nearly 25 percent more forage (3 yr. average) than the unfertilized plots. Iowa research showed that anaerobic swine lagoon effluent (which has a lower nutrient content and higher salt content than liquid manure) could be applied at rates of up to 20 inches/year without detrimental effects on corn yields; however, grain sorghum yield were decreased up to 50 bu./acre by effluent applied at all rates. In North Carolina, swine lagoon effluent application rates of up to 24 inches/year for two years were not detrimental to yield or mineral content of coastal bermudagrass. (Bates-East Central)

4494-A6, B1, F2
REGULATION OF ODORS THROUGH NUISANCE LAWS

Anonymous
Agricultural Engineering Newsletter, V. 1, No. 10, p. 2-3, Dec., 1975.

Keywords: Odor, Legal aspects, Nuisance lawsuits.

This is an update on "Legal Aspects of Odors and Dust from Feedlots", an extension leaflet available in the *Texas Cattle Feeders Handbook*. The primary means of regulating odors is through public and private nuisance lawsuits. Forms of public regulation of odors by agencies in Texas are as follows: (a) Nuisance regulation (Rule 5) of Texas Air Control Board (TACB), (b) TACB construction and operating permits for new sources, (c) Texas Clean Air Act, (d) Texas Criminal Misdemeanor Law. The EPA has no regulatory programs on odor, because it believes that odor is a local rather than national problem. Private regulation of odors occurs through the "nuisance law". A private lawsuit is brought between neighboring parties under this law and usually involves a jury trial. Nuisances are usually classified in legal terms as follows: (a) Public Nuisance - large numbers of people affected. (b) Private Nuisance - few people affected. Recent trends in odor nuisance suits involving livestock operations appear to include the following: (a) Feedlots near or in town (public nuisances) are ejected, with or without compensation. (b) Land developers/speculators have not been successful in claiming damages from reduced property values. (c) Feedlots with reasonable location and waste management practices can provide successful defense against nuisance suits. (d) Flagrant disregard for proper waste management results in expensive punitive damages. (Bates-East Central)

4495-B2, B3
PREPARE FOR WINTER

Anonymous
Feedlot Management, V. 18, No. 11, p. 18, Nov., 1976.

Keywords: Feedlot management, Manure pack, Drainage, Cleaning, Solid wastes, Liquid wastes, Winter.

Now is the time for feedlots to get into shape for winter, says Dr. John Sweeten, agricultural engineer at Texas A&M University. The following maintenance procedures are suggested for winter preparation: 1. Collect surface manure frequently to reduce manure volume. 2. Leave a 2-inch manure pack to decrease water infiltration. 3. Remove manure from fence lines and alleys to promote drainage. 4. Backfill potholes and surface depressions. 5. Construct long, low, broad mounds in pens with drainage problems. 6. Empty runoff holding ponds. 7. Remove sediments from drainage channels. In short, Sweeten says, the basic principle for winter preparation is to keep a minimum quantity of manure and wastewater on hand before winter arrives. (Bates-East Central)

4496-A3, C2
NONPOINT SOURCE POLLUTION FROM AGRICULTURAL RUNOFF

Departments of Agricultural Engineering and Civil Engineering, Cornell University, Ithaca, New York
D. A. Haith and J. V. Dougherty
Journal of the Environmental Engineering Division, Proceedings of the American Society of Chemical Engineers, V. 102, No. EE5, p. 1055-1069, 1976. 1 fig., 7 tab., 39 ref.

Keywords: Water pollution, Nonpoint sources, Agricultural runoff, Snowmelt runoff, Nitrogen, Phosphorus, Agricultural watersheds.

An operational procedure has been developed which is suitable for estimating nonpoint source water pollution due to runoff from agricultural land and is sensitive to regional variations in weather, soils, and crop management. Although not presently applicable to snowmelt runoff, the procedure could be extended to winter runoff by use of suitable snowmelt estimating methods. Nitrogen and phosphorus in agricultural runoff were estimated for a five-watershed area totaling 578 sq km in Broome and Tioga Counties, N.Y., for the years 1971 and 1972. Comparison was made with two other estimates which were obtained using areal loading factors (losses of nutrients per unit area). Although the three different estimates were of comparable orders of magnitude, the loading factor estimates were not sensitive to the soils, weather, and crop distributions of the study region, and may overestimate losses of nitrogen in agricultural runoff. (Copyright 1976-Journal of the Environmental Engineering Division, ASCE)

4497-A11, B3, C2, E3
POULTRY LITTER FOR INTENSIVE BEEF PRODUCTION

Faculty of Agriculture, The Hebrew University of Jerusalem, POB 12, Rehovot, Israel
H. Tagari, D. Levy, Z. Holzer, and D. Ilan
Animal Production, V. 2, Pt. 3, p. 317-327, 1976. 1 fig., 5 tab., 22 ref.

Keywords: Poultry litter, Refeeding, Diets, Digestibility, Protein, Energy, Performance, Sheep, Cattle.

The nutritional value of a pelleted fattening concentrate mixture, in which heat-sterilized poultry litter (PL) was included at rates of 0, 15, 25 and 35 percent, was studied. A digestion and nitrogen balance trial was carried out with rams, and a feeding trial was carried out with intact male cattle from the age of 8 mo. to slaughter at 14 mo. Digestibility of crude protein was related inversely to PL content of the diet. This decrease in digestibility was not accompanied by a decrease in the quality of the protein digested. Gross and digestible energy contents of the diets were related inversely to their PL content. There were no significant differences in blood urea concentration. A concentrate mixture containing 1 percent urea but otherwise similar to the control, was included in the feeding trial. There were no significance only with the extreme treatments. Feed intake on PL-containing diets was higher than on the control diet, but feed tended to be related inversely to PL percent in the diet, but they were small and reached significance only with the extremen treatments. Feed intake on Pl-containing diets was higher than on the control diet, but feed conversion efficiency was impaired when the proportion of PL exceeded 25 percent. No significant correlations were found between total volatile fatty acids in rumen liquor and daily liveweight gain. (Copyright 1976-Animal Production)

4498-A8, B2, C2, E2

NITROGEN LOSS IN SWINE WASTE APPLICATION STUDIED

J. D. Kendall
Feedstuffs, V. 49, No. 40, p. 12, Sept. 26, 1977.

Keywords: Land application, Nitrogen losses, Swine wastes, Liquid wastes, Broadcasting, Cultivating, Soil injection, Weather, Soil types, Costs, Labor.

The effect of land application methods on nitrogen loss in liquid swine manure was studied by Purdue University researchers, J. D. Hoff and A. L. Sutton, and was reported on during Purdue Swine Day. The purpose of the research was to: (1) Determine nitrogen losses from anaerobic liquid swine manure applied to the soil by (a) broadcasting; (b) broadcasting and immediate cultivation or (c) injection or knifing into the soil, (2) Determine the effects of weather conditions and soil types on nitrogen loss from swine manure applied to the land and (3) Compare costs and labor inputs of each application method. The study was conducted with the following application rates: 0 (control); 40 tons/acre; 60 tons/acre; and 80 tons/acre. Soil types were Crosby silt loam, Linwood muck, and Oaktown loamy fine sand. Ammonia nitrogen loss was greatest from manure applied by broadcasting and lowest with the injection application method. Ammonia loss was higher from sandy soils with low-water holding and cation exchange capacities. Ammonia loss was lowest in the silt loam soil. Ammonia loss was highest during high temperatures and dry windy weather. Most of the ammonia was lost within three days after manure application. Odor and fly concentrations were very high with all broadcast applications. Hoff and Sutton noted that there was no difference in labor requirements between the broadcast and injection application methods. The researchers also suggested several manure management tips. (Bates-East Central)

4499-B2, D1, D3

LAGOONS & 'GATORS

J. R. Dawson
Confinement, V. 2, No. 8, p. 6, Sept., 1977.

Keywords: Lagoons, Alligators, Waste treatment, Aeration, Florida.

Butch Deloach of Metter, Georgia has a unique addition to his 3½ acre swine manure lagoon -- an 8½ foot alligator called Charley. His official title being ''lagoon aerator,'' Charley further contributes by disposing of afterbirth from Deloach's 1000 farrowings/year farm. He also disposed of any live animal entering the lagoon, but a dead animal (regardless of how recent it's passing) is invariably rejected. Charley doesn't hibernate in the winter. Deloach speculates that this might be because the lagoon water temperature may be warmer than the fresh-water ponds, although he has never taken comparative readings. Plans were made to capture the 'gator and turn him over to the conservation people for relocation, but attempts made so far have failed. (Bates-East Central)

4500-A10, B1

SOME EFFECTS OF THE AMBIENT ARTHROPOD COMPLEX ON THE DENSITY AND POTENTIAL PARASITIZATION OF MUSCOID DIPTERA IN POULTRY WASTES

Division of Biological Control, Department of Entomology, University of California, Riverside, California 92502
E. F. Legner
Journal of Economic Entomology, V. 64, No. 1, p. 111-115, 1971. 2 fig., 2 tab., 14 ref.

Keywords: Poultry manure fauna, Parasites, Fly control

The observation in nature that pupal parasitism of certain muscoid Diptera was highest at lower viable host densities may emphasize the importance of the hosts' destruction in the developmental stages prior to parasitization. Inoculation of fumigated and unfumigated habitats with *Musca domestica* L. eggs demonstrated 53.4 to 99.45 percent mortality in the presence of predatory and scavenger anthropods. Explanation of probable causes of the negative correlation of parasitization with apparent increasing densities of the host are advanced. (Legner-University of California)

4501-A11, B1, C2

SODIUM LEVELS IN BEEF CATTLE FINISHING RATIONS AS RELATED TO PERFORMANCE AND CONCENTRATION IN FEEDLOT SOLID-WASTE

Texas Tech University Center at Amarillo, Pantex, Texas 79069
R. H. Klett, K. R. Hansen and L. B. Sherrod
ICASALS Contribution No. 102, Texas Tech University Center at Amarillo, 1972, p. 11-16. 3 tab., 9 ref.

Keywords: Rations, Sodium, Cattle, Performance, Feedlot wastes, Sampling.

One-hundred-eight steers were divided equally into six treatments with three replications of six steers each and fed rations containing 1.0 percent, 0.5 percent, 0.25 percent, 0.125 percent, 0.0625 percent and 0.0 percent salt (NaCl). Animal performance was measured by 28 day weights, feed consumption, feed conversion by pens, and carcass traits. Sodium (Na) concentration and build-up in the solid-waste was measured periodically by sampling the feedlot with a coring device. Sodium concentration in the rations was not significantly related to average daily gain, feed intake, or carcass traits. There was a significantly (P .05) poorer feed conversion at the 1.0 percent level, but the effect was attributed to animal variations. Data suggested that Na content of feedstuffs in finishing rations provide sufficient levels to meet requirements without supplemental sodium. Sodium intake per day for treatments 1 through 6 was 37.1, 18.9, 10.0, 5.3, 2.8 and 0.7 g per head daily and was not related to ration consumption. Sodium concentration in the solid-waste was linearly related to Na intake. Levels of Na accumulation in the solid-waste appeared to be sufficiently low so as not to be harmful in runoff or to croplands if applied at 10-15 tons per acre every 3-4 years. (Klett-Texas Tech University Center at Amarillo)

4502-B2, C1

THE EFFECT OF TOTAL SOLIDS CONTENT, PARTICLE SIZE, FLOW VELOCITY, AND VISCOSITY OF BEEF MANURE SLURRY ON HEAD LOSS IN PVC PIPE

M. J. Rolfes
M.S. Thesis, Department of Agricultural Engineering, University of Nebraska, Dec., 1974, 72 p. 20 fig., 5 tab., 29 ref.

Keywords: Design, Slurries, Cattle wastes, Hydraulic pipe transport, Head loss, Total solids, Particle size, Flow velocity, Viscosity.

The purpose of this study was to provide the engineer with head loss design information for hydraulic pipe transport of housed beef cattle manure slurries. Slurry consistencies were selected to range from 6-14 percent total solids content, limiting study to non-Newtonian pumpable slurries. A flow rate of 1 ft/sec was considered minimum to prevent slurry settling and clogging in the pipeline. The maximum flow velocity used was determined by available pump capacity, slurry total solids content, and pipe diameter used; however, a flow velocity of 10 ft/sec was considered maximum for field applications. Pressure ranges were limited by pump capability to a total dynamic head of 55 feet of water. Temperature ranges were dictated by prevailing climatic temperatures. Two-, three-, and four-inch diameter PVC pipe was selected to study conversion to other pipe diameters. Pipe layout was designed with return flow for slurry recycling. Friction head loss test sections were 50 feet long. A Brookfield viscometer provided the basis for determining slurry viscosity. The study included 3 tests of beef manure slurry friction losses each with the same source of beef slurry. Among the study conclusions were the following: (1) Beef manure friction head losses in PVC pipe are significantly greater than those of water. (2) Beef manure slurry friction losses decrease exponentially with pipe diameter increase at a negative rate. (3) Conversion of friction loss data to larger pipe size is possible as indicated by the consistent friction head loss curve patterns of the three pipe sizes studied. (4) Slurry particle size distribution was not a factor in determining head losses of particles greater than 0.5 mm. (5) Viscometric data indicated beef manure slurries were non-Newtonian (viscosity decrease with shear rate increase). A beef manure slurry viscometric classification can be useful in slurry studies. (Merryman-East Central)

4503-B2, B4, C1, C2, E2

BEEF CATTLE FEEDLOT RUNOFF AND CONTROL IN EASTERN NEBRASKA

L. P. Schram Feed Lot, Inc., Papillion, Nebraska
L. P. Schram
Environmental Protection Agency Report EPA-600/2-77-159, Aug., 1977, 31 p. 3 fig., 7 tab., 22 ref.

Keywords: Agricultural runoff, Runoff control, Feedlots, Cattle, Debris basins, Holding ponds, Chemical properties, Physical properties, Land disposal.

This study was initiated to determine operational characteristics of runoff control facility components for beef cattle feedlots. A runoff control facility was designed and constructed for a 3,000 head capacity feedlot in eastern Nebraska. Components of the runoff control facility included debris basins inside the pen and outside the pen, a holding pond, and a disposal system. Results indicated that design volumes for the debris basins and holding ponds were effective in controlling runoff from the lots caused by snowmelt and rainfall for climatic conditions within eastern Nebraska. Characteristics of runoff transported solids from this large lot compared favorably with values developed earlier on small research lots. All values for total and volatile solids, electric conductivity, pH, nitrogen, phosphorus, and COD were within published ranges. (Schram-L. P. Schram Feed Lot, Inc.)

4504-B2, B3, C2, D1, D2, D3, E3, F1

MANURE IS NOW A COMMODITY

Anonymous
Calf News, V. 15, No. 10, p. 44-45, Oct., 1977. 4 fig.

Keywords: Feedlots, Manure,Recycling, Biogas, Colorado, Methane, Carbon dioxide, Feed supplements, Refeeding, Economics, By-product recovery, Algae.

Three large feedlots – Colorado Beef Producers, Beef City, and the Terry Turner Feedlot – all in the Lamar County area of Colorado, have joined in a program to recycle the manure from their combined 50,000 head capacities to produce methane gas to sell, carbon dioxide to supply the algae to purify the water and a resulting "cake" to refeed their cattle. At this three-lot operation in Lamar, a total system is contemplated which will cost $10 million. The project is expected to be financed by a low-interest FMHA loan over a 40-year period. Such a system should not be considered for lots of less than 1,000 head. (Merryman-East Central)

4505-B2, B4, B5, E2, F1, F2

AN ECONOMIC ANALYSIS OF THE INVESTMENT AND OPERATING COSTS ASSOCIATED WITH LIQUID MANURE HANDLING AND DISPOSAL ON FEEDER HOG ENTERPRISES IN ONTARIO

School of Agricultural Economics and Extension Education, University of Guelph, Guelph, Ontario, Canada
J. H. Clark and M. F. McKenna
Working Paper No. AE/73/9, School of Agricultural Economics and Extension Education, University of Guelph, Guelph, Ontario, 1975, 1o p. 7 tab., 5 ref.

Keywords: Swine wastes, Liquid wastes, Ontario, Canada, Waste storage, Waste management, Waste disposal, Economics, Costs, Land spreading, Pumps, Floors, Regulation.

A study of investment and costs of liquid hog manure storage and handling facilities in Ontario indicated that both storage and spreading facilities can be expensive, but that these costs can be covered by savings in fertilizer costs if the buildings are located on farms of larger than 100 acres of cropland, with densities of 10 hogs per acre or less. A survey of 136 feeder hog buildings in Ontario revealed the following: (1) Two spreader systems were in use – a vacuum tank and an impeller pump system. Impeller pumps were used mainly with deep storage tanks. Vacuum systems were used mostly with shallow gutter tanks inside buildings. The vacuum system was slightly less costly for herds of less than 2,000 hogs, but because of lower capacity was a little more expensive to operate for units larger than 2,000 hogs marketed per year. Spreading costs ranged from 35c to $1.00 per hog marketed. (2) Storage facilities varied from 6 weeks to 6 months with the buildings operated at capacity. The storage tanks cost about 5c per gallon of capacity to build. (3) Liquid manure can be handled by using partially slatted floors or gutters. For both systems the average cleaning time per day is about 20 minutes for herds where about 1,000 hogs are marketed per year. Floor investment ranged between $2.50 to $3.70 per hog marketed depending upon size of building and type of floor built. (4) Liquid hog manure can be worth up to $8.86 per 1,000 gallons or $1.55 per hog fed if it is used to replace commercial fertilizer and spread in the spring. However, storage and spreading costs can easily be greater than this value. Thus farmers reduce storage costs by spreading manure at other times of the year and minimizing storage facilities. (5) If spreading of the manure is restricted in winter months, net value of the manure is decreased 10-30c per hog except when the number of hogs marketed per acre of corn is greater than 10. Economic optimum storage facilities varied from 2½ to 4½ months for most hog-crop combinations. However, regulations prohibiting spreading in winter months require capacities of 4.5-6 months. (Clark-University of Guelph: Merryman, ed.)

4506-B1, D1, D2, D3, E1, F1

ANIMAL PRODUCTION IN SINGAPORE -- PRESENT STATUS AND TRENDS

Primary Production Department, Singapore
S. T. Woh
Symposium on Animal Research, Proceedings of a Symposium on Tropical Agriculture Researchers, Oct., 1973. Tropical Agriculture Research Series No. 7, Tropical Agriculture Research Center, Ministry of Agriculture and Forestry, Tokyo, Japan, Aug., 1974. p. 63-68. 3 tab., 4 ref.

Keywords: Production, Swine, Poultry, Intensification, Swine wastes, Waste treatment, Waste disposal, Economics.

In Singapore, competition for land use, further reduction in profit margin and environmental pollution from animal farming activities (particularly that of pigs) necessitate that emphasis for future livestock development should be the establishment of larger and more intensive units of production. Such development is being encouraged by the Government. Intensification will result in the displacement of the majority of the small farms and will introduce expertise both foreign and local and also a considerable degree of vertical integration into the industry. Intensification will upgrade farming practices, generate greater sophistication in management and demand higher standards of disease control measures. Pollution controls will have to be incorporated into the management programs. It has been suggested that a reduction of the polluting load of swine wastes may be achieved by removal of the solid waste either at source or after washing by mechanical separators, filtraiton or sedimentation. Other recommendations include "zero-discharge" with no treatment but removal for the smaller farms and on-the-farm treatment for the larger farms where economics favor such a process. Also, it has been urged that consideration be given to waste removal to central treatment facilities. Sea disposal might be considered as a means of final disposal. (Bates-East Central)

4507-A6, B2, B3, B4, C1, C2, D1, D2, D3, F1

KEEP YOUR SLURRY SMELLING SWEET

C. Bell and M. Lewis
Dairy Farmer, V. 20, No. 9, p. 18-19, May-Sept., 1973. 3 fig.

Keywords: Dairy wastes, Waste treatment, Waste storage, Odor control, Composting, Pasveer oxidation ditch, Oxidation tower, Forced aeration, Lagoons, Barrier ditches, Anaerobic lagoons, Dehydration, Chemical treatment, Ammonium persulphate, Economics.

A number of treatment methods for cattle slurries are assessed in terms of their effects on odor. Methods considered were: composting, Pasveer oxidation ditch, oxidation tower, forced aeration processes, lagoons and barrier ditches, anaerobic lagoons, dehydration, and chemical treatment. The methods already in use on farms for storage, partial treatment and full treatment of cattle slurry – lagoons (aerobic and anaerobic), barrier ditches and forced aeration systems – when designed and used correctly are fairly efficient in eliminating the noxious odor from slurry. Results of such experimental treatment systems as oxidation ditches, oxidation towers and chemical treatment, should soon reveal the relative values of such systems for use on dairy farms for the full treatment of cattle slurries. One of the major factors prohibiting use of these systems is the high capital cost and also relatively high running costs. While the use of ammonium persulphate as a slurry deodorant holds promise, the high expenditure required per cow presently makes the treatment non-viable for the farmer. (Merryman-East Central)

4508-A11, B3, C2, E3

THE EFFECTS OF CONTINUOUS RECYCLING DRIED POULTRY WASTE IN LAYING HEN DIETS ON TRACE MINERALS FOUND IN VARIOUS TISSUES

Poultry Science Department, Michigan State University, East Lansing, Michigan 48823
S. K. Varghese and C. J. Flegal
Poultry Science, V. 51, p. 1882, 1972.

Keywords: Refeeding, Dried poultry wastes, Trace minerals, Poultry, Performance, Chemical properties, Arsenic, Mercury, Copper, Zinc.

An experiment has been conducted to study the effect of continuous recycling of dried poultry waste (DPW) in laying rations on the trace elements arsenic, mercury, copper and zinc found in kidney, liver, muscle, eggs and feces. A total of 588, 20-week old pullets were fed either 0 percent (control), 12.5 percent or 25 percent DPW. The DPW replaced corn in the diet on a kilogram per kilogram basis. After 23 cycles, eggs, feces and tissues were collected from three birds of each treatment and analyzed for the different elements for comparison. The data indicated that the levels of arsenic, mercury, copper and zinc were not appreciably altered in the tissues, feces or eggs by recycling DPW in the diet of laying hens. (Copyright 1972-Poultry Science) (Abstract only)

4509-B1, E3, F1, F4

ENERGY USE IN AGRICULTURE: NOW AND FOR THE FUTURE

Council for Agricultural Science and Technology
Report No. 68, Council for Agricultural Science and Technology, Aug., 1977, 28 p. 5 fig., 9 tab., 62 ref.

Keywords: Agriculture, Energy consumption, Energy sources, Electrical energy, Solar energy, Wind energy, Herbicides, Insecticides, Fertilizers, Greenhouse agriculture, Biomass fuels, Animal wastes, Recycling, Economics.

The purpose of this report is to provide concise answers to the principal questions of general concern about energy in agriculture. The subject matter is arranged in convenient question and answer form under the following headings: (1) energy use in agriculture, (2) energy sources, (3) crop production and harvesting, (4) animal agriculture, and (5) energy supply and farming. The farmer has available the following options for adjusting to increasing energy prices and decreasing supplies: (1) He may reduce energy use in such forms as fertilizer applications and tillage. Manure may be used, but manure cannot be hauled far if it is to compete with commercial fertilizers on a nutrient-cost basis. (2) He may substitute enterprises that consume less energy (such as producing soybeans instead of corn). (3) He may invest in alternative technologies that substitute energy inputs and reduce energy use. (4) He may invest in new technologies that use energy sources such as the sun, the wind, or biomass. Several options are available for deriving energy from animal wastes. One is to recycle the material as feed through other animals. The second is to add material to the soil. The third is to use the material to produce combustible gases. (5) He may modify his farm enterprises to make them more efficient for his particular environmental conditions. (6) He may cease farming if the adjustments are too difficult or expensive or if they reduce production too much. (Merryman-East Central)

4510-A5, B2, C2, C2, E1

POLLUTANT MOVEMENT TO SHALLOW GROUND WATER TABLES FROM SWINE WASTE LAGOONS

Department of Agronomy, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
T. G. Ciravolo, D. C. Martens, D. L. Hallock, E. R. Collins, Jr., and E. T. Kornegay
Bulletin 100, Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, March, 1977, 61 p. 7 fig., 21 tab., 32 ref.

Keywords: Swine wastes, Waste disposal, Anaerobic lagoons, Groundwater quality, Groundwater monitoring, Pollutant movement, Biological properties, Chemical properties, Seepage.

This research investigated the effect of three anaerobic swine-waste lagoons on the quality of nearby ground water. The lagoons, in the Coastal Plain region of Virginia, were located on soils with high water tables and with varying drainage characteristics. Over a 14-month period in 1974 and 1975, ground water samples were taken from wells located at various depths and distances from the lagoons. These samples then were analyzed to determine the extent of contamination due to the lagoons. The biological constituent analyzed was the number of fecal coliform bacteria; chemical constituents analyzed were concentrations of Cl, Cu, Mn, NH_4-N, NO_3-N, PO_4-P, and Zn. Research findings showed that the quality of ground water was affected least around one lagoon constructed at ground level in a poorly drained soil with a clay subsoil. No ground water contamination was found more than 3 m from this lagoon. In contrast, ground water around two lagoons constructed with embankments above ground level, one in a sandy clay loal subsoil and the other in a sandy subsoil, showed traces of swine-waste components as far away as 30 m. Pollutant levels in ground water around the former lagoon were below U.S. Public Health Service drinking water standards, while pollutant levels around the latter lagoon exceeded those standards on many occasions. These experimental results indicate that seepage may occur from lagoons with embankments above ground level in sandy soil, and that biological sealing in such lagoons may not sufficiently protect shallow aquifers from contamination. (Ciravolo-Virginia Polytechnic Institute and State University)

4511-B1, C2, D1, D2, D3, E2, E3, F1

DESPITE SCIENCE, IT'S STILL MANURE

J. B. Gerrish and F. W. Bakker-Arkema
Michigan Farmer, p. 10, 12, March, 1974. 1 fig.

Keywords: Livestock wastes, Recycling, Energy, Pyrolysis, Hydrogasification, Biogas, Fermentation, Methane, Ethane, Hydrogen, Carbon monoxide, Char, Effluent, Fertilizer, Land spreading, Economics.

Consideration is given to 3 schemes currently under investigation for converting animal wastes into highly prized energy sources such as methane or liquid fuel. The first is pyrolysis, a process that subjects organic matter to high temperatures (around 500 C or 900 F) in the absence of air. A mixture of products results from this treatment. The gases that are derived are methane, ethane, hydrogen and carbon monoxide. The solid output is char. Unfortunately, the energy required to operate the process is more than the energy harvested. Hydrogasification is a variation on the pyrolysis in which organic matter such as manure is subjected to very high temperatures (1500 C) and very high pressures (2,000 psi). So far this process does not seem very feasible either. Methane generating fermentation is another energy scheme on a technical level suitable for the do-it-yourselfer. The process consists of keeping a digester tank of diluted manure warm, stirred, and free of air. Bacteria will produce a gas that is about 60 percent methane, 40 percent carbon dioxide, and has small amounts of smellier gases. A big disadvantage of this system is that it's liquid output is about twice the volume of what goes into the tank. This effluent has most of the original fertilizer value of the manure and must be disposed of on land. The gas is not pure enough to transport or even compress very much since it contains so much carbon dioxide. A recently published EPA report considered such schemes as those discussed here and concluded that spreading manure on the land is still a pretty attractive way to go. (Merryman - East Central)

4512-A8, B1, C2

THE SPATIAL DISTRIBUTION OF EXCRETA UNDER INTENSIVE CATTLE GRAZING

Fisons Limited -- Fertilizer Division, North Wyke Experimental Station, Devon, England
I. R. Richards and K. M. Wolton
Journal of the British Grassland Society, V. 31, p. 89-92, 1976. 2 fig., 1 tab., 18 ref.

Keywords: Cattle wastes, Grazing, Pasture land, Excreta distribution, Swards, Plant response, Potassium.

The spatial distribution of excreta from intensive cattle grazing was recorded and was described by a negative binomial function. This enabled the proportion of a pasture surface affected by excreta to be calculated for various grazing periods. Where the effect of excreta on the sward was short-lived, as for urine N, or where the total area covered by excreta remained small, as for dung, then little over-lapping of effective excreta patches could be expected. Appreciable overlapping of effective patches could, however, occur for the long-lived urine K effect and this should be taken into account when estimating the proportion of a pasture surface affected. (Richards - North Wyke Experimental Station)

4513-B5, E2

EFFECTS OF NITROGEN, PHOSPHORUS, POTASSIUM, AND MANURE FACTORIALLY APPLIED TO POTATOES IN A LONG-TERM STUDY

Research Station, Agriculture Canada, Charlottetown, Prince Edward Island, Canada
W. N. Black and R. P. White
Canadian Journal of Soil Science, V. 53, No. 2, p. 205-211, May, 1973. 5 fig., 2 tab., 13 ref.

Keywords: Land application, Barnyard manure, Nitrogen, Phosphorus, Potassium, Potatoes, Crop response.

The effects of N, P, K, and manure factorially applied to potato [*Solanum tuberosum* L.) yields, starch content, and soil and tissue nutrient levels were evaluated on continuous plots over 12 yr in a 4-yr potato, grain, hay, hay rotation. Although yield responses were observed with N, P, and K applications, manure application substantially increased yields above yield levels due to applied N, P, and K. Increasing rates of KC1 strongly depressed tuber starch contents. Soil test P and K levels increased with repeated fertility applications, leaf tissue levels were increased with N, P, and K treatments. (Copyright 1973 - Journal of Soil Science)

4514-A11, B2, C2, E2

RETENTION BY SHEEP OF COPPER FROM AEROBIC DIGESTS OF PIG FAECAL SLURRY

Rowett Research Institute, Bucksburn, Aberdeen, AB2 9SB, Scotland
A. C. Dalgarno and C. F. Mills
Journal of Agricultural Science, V. 85, p. 11-18, 1975. 3 fig., 1 tab., 22 ref.

Keywords: Swine wastes, Slurries, Aerobic treatment, Land disposal, Herbage, Forages, Copper content, Ingestion, Sheep, Animal health.

Dried grass originating from a farm on which herbage had been repeatedly dressed with faecal slurry from pigs given diets containing 250 mg copper/kg had a very variable, but frequently high content of copper. A maximum content of 70 mg Cu/kg dry matter was found. The mean copper content of growing herbage sampled subsequent to this finding was 10.5 mg/kg, while residues of slurry on the soil surface contained 805 mg Cu/kg. In an experiment involving three groups of eight sheep the utilization and hepatic retention of copper from the solid residues of an aerobic digest of high-copper faecal slurry from pigs was investigated. When these residues constituted 1 or 2 percent of the dietary dry-matter intake of copper-deficient sheep, rapid increases in plasma copper content, in plasma ferroxidase I activity and in hepatic copper content occurred. Thus copper from this source was readily utilized and retained. The utilization of copper added to the diet as cupric sulphate was compared with that of copper from dried slurry solids in an experiment with two groups of four sheep. Although the rate of recovery of plasma copper and ferroxidase I activity tended to be slower in sheep given slurry solids this different was not statistically significant. A significantly slower rate of increase in hepatic copper content resulted from the ingestion of slurry solids. The significance of these findings is discussed with particular respect to the inadvertent ingestion of residues from the soil surface of pastures dressed with slurry and from the variable inclusion of such residues in herbage uplifted during forage harvesting. (Copyright 1976 - Journal of Agricultural Science)

4515-B1, D1, E2, E3

SOLAR ENERGY HELPS DRY POULTRY WASTE

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 98, Sept. 10, 1977.

Keywords: Solar drying, Poultry wastes, Heating, Recycling, Fertilizers, Refeeding.

Research is being planned at Michigan State University to build a solar collector out of common farm building materials (2 x 4's, plywood, corrugated aluminum roofing, and glass) for use in heating a chicken house. The heat generated will be used in two ways. In winter, it will provide supplemental heat for the poultry house. Year-round, the heated air will be used to dry the chicken droppings. The sun-warmed air will be distributed by way of plastic ducts and fans. The dried poultry waste is easier to handle and store and also has lost the ammonia smell. This material makes an excellent fertilizer or can be refed to chickens or cattle with nutritional equivalent close to soybean meal for cattle. Results are expected to be announced by next summer. (Bates - East Central)

4516-A11, B1, E3

MILO-MANURE SLURRY BEATS RECONSTITUTING

Anonymous
Beef, V. 14, No. 2, p. 66, Oct., 1977. 1 tab.

Keywords: Refeeding, Cattle wastes, Milo, Cattle, Performance.

Lowell Schake, Texas A&M, has devised a way to improve the feed value of dry ground milo. He combined the dry ground milo with manure slurry from a confinement barn. The Texan put together a combination of 26 percent excrement and 73 percent air-dry milo grain. In feeding trials, the resulting excrement-reconstituted grain mix outperformed both dry rolled milo and milo reconstituted with plain water. All three types of milo were rolled as they came out of storage, immediately before feeding. The steers weighed 519 pounds going on feed. Schake also noted a careful study failed to turn up any significant differences in the excrement-fed cattle. (Bates - East Central)

4517-B1, C2, E2

MANAGING MANURE WILL SAVE YOU THE MOST ENERGY DOLALRS

J. B. Holter
Hoard's Dairyman, V. 122, No. 19, p. 1152-1153, Oct 10, 1977. 1 fig., 3 tab.

Keywords: Energy, Manure management, Dairy industry, Land disposal, Fertilizers, Forages, Crops, Crop response.

The objective of this article was to take a good look at major fuel equivalent (FEQ) inputs on dairy farms with regard to growing various crops and converting them into milk. It was concluded that efficient handling of manure from the cow to the field, and judicious use of manure nitrogen to spare chemical (manufactured) nitrogen offer the most significant potential for conservation of fossil fuel on most dairy farms. (Merryman - East Central)

4518-A8, B2, B3, B5, C2, E2, F1

MANURE CAN BE A PROFITABLE FERTILIZER

Anonymous
The Ohio Farmer, V. 259, No. 5, p. 28-29, March 5, 1977.

Keywords: Manure, Swine wastes, Land application, Fertilizers, Economics, Nutrients, Crop response.

Purdue University Extension Specialist A. L. Sutton says that use of manure as a fertilizer at today's fertilizer prices is economical. A ton of solid swine manure is worth about $3.50, based on today's fertilizer nutrient prices. Liquid swine manure from a deep pit is worth about $11.50 per 1,000 gallons. For most efficient use, nutrient analysis of the waste to be applied, compared with a soil test of the land, and the nutrient requirements of the crops to be grown should be performed. Grasses and cereal grain crops usually respond most favorably to the nutrients contained in manure. Suggestions for efficient use of manure include: (1) Apply manure uniformly as near as possible to the planting date. Sufficient time should be allowed for incorporating the manure into the soil so that it will become diluted with soil water. (2) Inject liquid manures beneath the soil surface and incorporate solid manure into the soil immediately if possible, to maximize the fertilizer value and minimize odor problems. (3) When ground is frozen, apply manure only to relatively flat or level land to prevent runoff when snow melts or during fast thaw. Do not spread liquid manure on water saturated soils where runoff is likely to occur. (4) Agitate or mix liquid manures thoroughly in pits to facilitate removal of settled solids and thus insure uniform application of nutrients to the land. (Merryman - East Central)

4519-B1, C1, C2, D3, E3, F1

METHANE GAS ENERGY POSSIBLE FROM MANURE

Anonymous
The Ohio Farmer, V. 259, No. 5, p. 44, March 5, 1977.

Keywords: Recycling, Livestock wastes, Waste treatment, Methane, Economics, Moisture content, Temperature.

Richard K. White, Ohio State University extension agricultural engineer, feels that production of methane gas from manure appears to have some merit in solving fuel problems in the future but that more research and development will be necessary before it is ready for commercial use. Current drawbacks of such production are the necessity for high capital investment and necessity for the greatest of care and management. A digester must function properly to aid production of methane gas from manure. Moisture content in the manure must continually be between two and four percent. Temperature in the digester must remain between 90 and 95 degrees F and the waste should be mixed by pumping air throughout the mixture. Manure collection must be on a daily basis. (Merryman-East Central)

4520-A8, B3, B5, C2, D1, E2

PROFITS FROM MANURE: WORKERS LIST TREATMENTS, APPLICATION

R. Leidahl
Feedstuffs, V. 49, No. 42, p. 16, 18, Oct. 10, 1977. 2 tab.

Keywords: Poultry wastes, Land application, Drying, Nutrients, Crop response, Superphosphate, Litters.

Poultry manure can provide an additional source of income from regular poultry operations. Extension poultry specialist Herbert C. Jordan and extension agronomist W. Wayne Hinish suggest that poultrymen dry poultry manure as it is produced and have nitrogen, phosphorus, and potassium tests run on samples. The seller should also advise the buyer of application rates, suggesting that the manure be stored in a cool, dry place and applied lightly and uniformly. The most common buyers of the product are general crop farmers, fruit growers, and mushroom growers. Poultry manure is not recommended for small grains or acid-loving plants or if excessive vine or foliage growth of vegetable and small fruit crops occurred in the last season. Nitrogen loss from poultry manure through fermentation can be reduced through use of ventilated, well-insulated houses, use of litter materials which rapidly dry the manure and application of superphosphate to reduce loss of nitrogen as ammonia. Superphosphate reinforces the phosphate content and reduces ammonia fumes. While litter use lowers plant nutrient content of the manure-litter mixture, some types of litter dry the droppings quickly and preserve more of the plant nutrients. (Merryman-East Central)

4521-A8, B5, E2

A LONG-TERM ROTATIONAL AND MANURIAL TRIAL IN UGANDA

Serere Research Station, P. O. Soroti, Uganda, Africa
A. R. McWalter and R. H. Wimble
Experimental Agriculture, V. 12, No. 3, p. 305-317, 1976. 13 tab.

Keywords: Land application, Africa, Manure, Green manures, Crop response, Application rates.

An experiment was conducted from 1936 - 1964 to determine: (1) the minimum period of rest necessary to maintain fertility in a five-year rotation which included arable crops and a variable period of rest, (2) the best type of cover during rest, (3) the effect of green manuring, and (4) the dosage of animal manure necessary, in conjunction with the above. The experiment followed a five-year rotation and was divided into five series, each of 90 sub-plots, which were opened successively in the years 1936-40 inclusive, so that each phase of the rotation was represented every year. In a complete cycle, each crop of the rotation was grown on each of the 5 series in turn. There were 2 replicates in each series, making 10 replicates in all, each with 15 main plots accommodating all combinations of 3 crop-rest sequences and 5 types of resting treatment. Levels of manuring were M_0= nil, M_1 = 6.3 tons per hectare, and M_2 = 12.6 tons per hectare. The 5 types of resting treatment were: A = natural regeneration, B = planted with grass, undisturbed, C = green manure, lopped, D = planted with grass, cut in Cycle I, grazed in cycles 2-4, and E = green manure dug-in. Yield trends differed from crop to crop, and a critical level of total soil nitrogen is suggested in partial explanation. Responses to farmyard manure in most crops increased over the years with increasingly marked negative curvature in a pattern that showed most strongly in cotton crops immediately following manure application. (Merryman - East Central)

4522-A11, B2, B3, C2, D1, D2, E3, E4, F1

ON STRAW AND GOLD, MANURE AND ALGAE -- FEEDING WASTE -- IT'S BEING DONE ... IN A VARIETY OF WAYS

Anonymous
Confinement, V. 2, No. 7, p. 17, July-Aug., 1977.

Keywords: Refeeding, Feeds, Poultry wastes, Cattle wastes, Swine wastes, Protein, Nitrogen, Potassium, Phosphorus, Calcium, Economics, By-product recovery, Algae, Yeasts, Oxidation mixed liquor, Houseflies, Earthworms, Ensiling.

Lewis W. Smith and William E. Wheeler, animal scientists with USDA's Agricultural Research Service, stated that animal excreta is an excellent source of protein with a value of $151 to $254 per metric ton as compared to $369 per metric ton for soybean meal. The values of the nitrogen, potassium, phosphorus, and calcium per metric ton of dry matter in various animal excreta are: $32.37 for poultry litter; $39.42 for poultry excreta; $23.58 for cattle excreta; and $31.57 for swine excreta -- as based on prices farmers paid for these minerals in 1977. Computer-balanced diets could contain 15 percent to 35 percent excreta for several selected classes on ruminants. Refeeding experiments have revealed that animal excreta is a valuable feed ingredient that is not utilized to its nutritional and economical potential. C. C. Calvert of the USDA's Agricultural Research Service recently discussed various biological systems that might be used to recover feed grade protein from animal excreta. Algae can be grown on animal slurry, harvested, and dried. Systems using yeasts have been found to be technologically feasible for converting nitrogen to protein. Such yeast has been successfully fed to swine and poultry as a dietary protein supplement. However, more critical research is needed on production systems using animal excreta as a substrate. Liquid from oxidation ditches containing mixed cultures of bacteria has also been fed to cattle, swine, and poultry with varying degrees of success. A better way of using this system might be to first use bacteria to convert the excreta and then harvest the bacteria as a protein source. Houseflies and earthworms grow on animal excreta and are a suitable protein source for livestock and poultry, too. However, since these invertebrates extract preformed protein from excreta (as opposed to converting inorganic forms of nitrogen to protein), low protein yields and the problem of maintaining large populations of insects and earthworms limit the practical and economical application of this system at the present time. While none of the systems described currently contributes significantly to the supply of protein supplements for animal feeds, they do have potential to do so. (Merryman - East Central)

4523-A11, B2, C3, E2

THE OCCURRENCE OF SALMONELLAS, MYCOBACTERIA AND PATHOGENIC STRAINS OF *ESCHERICHIA COLI* IN PIG SLURRY

Institute for Research on Animal Diseases, Compton, Newbury, Berkshire, England
P. W. Jones, J. Bew, M. R. Burrows, P.R.J. Matthews, and P. Collins
Journal of Hygiene, V. 77, No. 1, p. 43-50, 1976. 2 fig., 2 tab., 13 ref.

Keywords: Swine wastes, Slurries, Bacteria, England, Salmonellas, Mycobacteria, *Escherichia coli*, Pathogens.

In research conducted by the Institute for Research on Animal Diseases, Compton, Newbury, Berkshire, 98 samples of pig slurry from 54 farms were taken and divided into 60 samples from 38 farms stocked with conventional pigs and 38 samples from 16 farms stocked with minimal disease pigs. These samples were cultured and then analyzed for the presence of salmonellas, porcine enteropathogenic strains of hemolytic *Escherichia coli*, and mycobacteria. Salmonellas were isolated from 12 farms (22 percent of total farms), 7 of which were minimal disease pig farms and 5 of which were conventionally reared pig farms. Enteropathogenic *E coli* were isolated from 13 farms (24 percent of total farms), 3 of which were minimal disease pig farms and 10 of which were conventional pig farms. Pathogenic mycobacteria were not isolated. (Bates-East Central)

4524-A8, B5, C2, E2

CHICKEN MANURE PLUS

Anonymous
Confinement, V. 2, No. 9, p. 24, Oct., 1977. 1 fig.

Keywords: Reclamation, Surface-mined lands, Land application, Ash, Sewage, Manure, Poultry wastes, Crop response, Chemical properties.

West Virginia University agronomists Robert Keefer and R. N. Singh have been testing sewage sludge, fly ash, and manure mixtures on reclaimed surface-mined lands to see if they can be used in revegetating the land. These waste materials are produced in large quantities near most metropolitan areas. Ash comes from power plants, sludge from sewage-treatment plants, and manure from a variety of agricultural industries. Keefer and Singh applied different combinations of waste materials to small research plots on reclaimed West Virginia mine sites. The plots were seeded with alfalfa and lespedeza, both of which are legumes, which can take nitrogen from the air. Chicken manure, either alone or in combination with ash and sludge, seemed to be the best additive. Compared with untreated areas on the test site, the plots treated with the waste materials had superior plant growth. (Merryman-East Central)

4525-A3, A8, B5, C1, C2, E2

MANURE MAKES CENTS

Anonymous
Agricultural Research, V. 26, No. 4, p. 15, Oct., 1977.

Keywords: Land application, Anhydrous ammonia, Feedlot manure, Crop response, Nitrogen, Phosphorus, Moisture content, Sorghum, Water infiltration, Agricultural runoff.

A. C. Mathers and B. A. Stewart, USDA soil scientists, conducted a 3-year study comparing manure with adhydrous ammonia. The feedlot manure used contained from 1.1 to 2.2 percent nitrogen, up to .53 percent phosphorus, and about 50 percent moisture. Sorghum grown on soil where the feedlot manure was incorporated 8 inches deep with a moldboard plow averaged 7,000 lbs. of sorghum per acre compared to 6,500 pounds per acre where anhydrous ammonia was chiseled into the soil. The scientists attributed the extra yield to increased water infiltration which resulted from the manure applications. Runoff water quality was not affected by either the anhydrous ammonia or the manure applications. (Merryman-East Central)

4526-A11, B1, F1

WHAT'S HOUSING REALLY WORTH?

S. Farlin and C. Gilbertson
Feedlot Management, V. 19, No. 10, p. 26, 28-30, Sept., 1977. 2 fig., 9 tab.

Keywords: Confinement pens, Housing, Floors, Economics, Performance, Nebraska, Cattle.

Dr. Stan Farlin and Conrad Gilbertson of the University of Nebraska have found the need for housing or shelter over a confinement facility to be questionable in the state of Nebraska. Several trials were performed to evaluate performance of cattle in housed and unhoused confinement situations. Results of these trials suggested that for environmental conditions similar to those in Nebraska, housing over slotted floors does not enhance performance of finishing beef cattle. Feedlot facility types available are outlined along with the breakdown on associated costs. A cross section of different floor types available to the feeder is also given along with the relative costs of the different kinds of floor designs. Cost estimates of floor types in a confinement facility vary from $114 per animal capacity of $159. (Merryman-East Central)

4527-A2, A8, B2, B5, E2, F2
FEEDER COMPLIES WITH REGULATIONS -- EPA OKAYED THESE PLANS TO STOP WASTE AND WATER RUNOFF

G. Lamp
Feedlot Management, V. 19, No. 2, p. 28, 30, Feb., 1977. 2 fig.

Keywords: Agricultural runoff, Legal asepcts, Environmental Protection Agency, Feedlots, Design, Runoff control, Settling basins, Holding ponds, Irrigation, Land disposal, Crop response, Legal aspects.

In 1972, Bob Kreikemeir consulted the local Soil Conservation Service and started making plans for reconstructing his feedlot to control runoff. The plans needed to include the EPA 10-year, 24 hour design storm requirement and to fit Kreikemeier's feedlot design. Once the plans were completed, they were submitted to EPA. They were approved. Kreikemeier obtained financial assistance from the Lower Elkhorn Natural Resources District at Norfolk. Their cost-sharing program paid for 80 percent of the dirt moving and 80 percent of the pipe laying – a total of nearly $2,500. The other expenses (about $1,500) were paid by Kreikemeir. The basic plan for the waste system involved making a settling pond at the base of the lot. A dike, 40 ft. from the fence to the peak, was built. The side of the settling pond nearest the road also required a dike, although this one was only 10 ft. from the road fence to the peak of the dike. Besides holding waste, the 2 dikes also act as a snowbreak for the cattle. Below the dike is the settling basin, designed to temporarily hold runoff until it is pumped to the holding pond. The holding pond holds 60 acre-inches of liquid. Effluent in the holding pond is used to sprinkler-irrigate a nearby field that is usually planted to corn. The system has been almost problem free and has entailed very little extra labor. An extra benefit of the system is the boost the effluent gives Kreikemeir's corn. (Merryman-East Central)

4528-B3, C2, D1, D3
IN-HOUSE MANURE DRYING

A. Elson
Poultry Industry, V. 37, No. 9, p. 14-15, Dec., 1973. 1 fig., 1 tab.

Keywords: Poultry wastes, Drying, Deep pit houses, Fully-stepped cages, Great Britain, Sterilization.

In some United Kingdom deep-pit poultry houses, fully-stepped cages are used which employ a slat system to dry poultry waste. The droppings fall directly onto 2 levels of timber slats and are held there for the life of the laying flock. The wastes are subjected to a continuous drying process during that time. The framed slats are supported from the house catwalks by metal straps. Two levels of slats are used at 2½-3 ft and 5-6 ft below the cages, the lower one being offset to collect the manure falling between slats in the upper set. Three-inch, four-inch or five-inch-wide slats are used and similar width gaps are used for the upper level. On the lower level, wider slats and narrower gaps help prevent manure from accumulating in the pit below. At the end of the year, after the spent laying flock has been removed, the manure is tipped from the slats into the pit. The slats are either removed from the house or swung up under the cages. This allows a tractor and foreloader to remove the dry "cones" of manure to the end of the house for milling and bagging off. If sterilization is required, a further process is necessary. An inexpensive chemical method is being developed. (Merryman-East Central)

4529-B5, C2, E2, F1
UTILIZING WASTE FOR FERTILIZER BASE

U. S. Department of Agriculture, Southwestern Great Plains Research Center, Bushland, Texas
B. A. Stewart
Feedlot Management, V. 19, No. 10, p. 22, 24-25, Sept., 1977. 2 tab.

Keywords: Agriculture, Energy consumption, Fertilizers, Manure, Land application, Nutrients, Economics.

Agriculture utilizes 3 percent of the total energy used in the United States, while the production of fertilizers accounts for 23 percent of all energy used in agriculture. The wise use of animal waste can be a significant practice in energy conservation. With careful use of manure from cattle feedyards and other animal complexes like dairy, swine and poultry operations, the chemical N demand in the United States could be reduced by 10 percent. Substantial quantities of P_2O_5 and K_2O would be supplied simultaneously, lowering the requirements of these nutrients from fertilizers. The biggest disadvantage of manure as a primary source of plant nutrients is the variability in chemical composition as a result of differences in ration, climates, and handling methods. In the Texas High Plains, 10 tons of manure were found to contain 268 lb. N, 243 lb. P_2O_5 and 362 lb. of K_2O. These values were based on the net weight of manure, which averaged 34.5 percent water. Because a portion of the nutrient value in manures is residual, a possible guideline is to assume that 60 percent of the total N is worth the equivalent cost of commercial N, and that 85 percent of the P_2O_5 and K_2O are worth their equivalent amounts in commercial fertilizer up to the amounts needed for crop production. For maximum utilization of manure nutrients, manure should be immediately incorporated into the soil after spreading to prevent volatilization and loss in runoff water. (Merryman-East Central)

4530-B2, D3, E3, F1
BACTERIA POWER GENERATOR, PRODUCE FERTILIZER IN IOWA

Anonymous
Feedstuffs, V. 49, No. 44, p. 6, 56, Oct. 24, 1977. 1 fig.

Keywords: Poultry wastes, Recycling, Iowa, Fertilizers, Energy, Algae, By-product recovery, Economics.

A project has been instigated at the Heying family poultry farm (near West Union, Iowa) for the purpose of recycling poultry wastes into energy and fertilizer. The project is being supported by a combination of funds from individuals, private companies and state and federal government agencies. When the system, which utilizes a gas-tight digester, is put into full operation, developers expect a return of about $107,000 annually in fertilizer and electricity, for about $50,000 profit. Cost of the system is about $150,000. Long-term plans for the Heying farm may include an algae pond on top of the digester tanks, which operate at the 95° F temperature most conducive to algae growth. Algae from the ponds, produced at about 40 tons/acre/year, could replace other sources of vitamins, mineral and protein in rations with corn to supply energy. Manure from the 160,000 layers at the farm should generate the electrical needs for lights and fans for the same birds, and leave material containing 300,000 lb. nitrogen, 200,000 lb. P_2O_5 and 150,000 lb. K_2O. If the project works as planned, nearly a dozen other firms will probably launch similar projects. One company official estimated that Iowa could support 60,000 of the units, and half that number would provide all the electrical power needed in Iowa. (Merryman-East Central)

4531-B1, B4, C2, E2, F1
STORAGE: STORE MANURE AS IF IT WERE VALUABLE; BECAUSE IT IS

Anonymous
Crops and Soils, V. 28, No. 2, p. 17, Nov., 1975.

Keywords: Fertilizers, Nutrients, Cattle manure, Dairy manure, Swine manure, Waste storage, Nitrogen, Phosphorus, Potassium, Soil injection.

Manure is a valuable commodity; treat it as such when storing it. The value of it is: 30 dollars for a dairy cow per year; 28 dollars for a beef animal; and 3 dollars for a pig. With nitrogen costing 20 to 22 cents per pound, phosphorus 13 cents, and potassium 6 cents, it makes good sense to preserve the fertilizer value of manure. New storage and handling techniques such as liquid manure injection into the soil allows a farmer to save much of the nutrient content and fertilizer value of manure. (Solid Waste Information Retrieval System)

4532-A3, A8, A11, B5, C2, E2
DAIRY CATTLE WASTE MANAGEMENT: ITS EFFECT ON FORAGE PRODUCTION AND RUNOFF WATER QUALITY

U.S. Department of Agriculture, Alabama A&M University, Normal, Alabama 35762
B. D. Doss, Z. F. Lund, F. L. Long, and L. Mugwira
Bulletin 485, Agricultural Experiment Station, Auburn University, Dec., 1976, 39 p. 10 fig., 15 tab.

Keywords: Dairy wastes, Land application, Crop response, Soil properties, Runoff quality, Alabama, Millet, Rye, Animal health, Tetany.

Research objectives were: (1) to determine how much dairy manure can be disposed of on crop land without damaging soil properties or lowering the quality of forage produced on the soil, and (2) to determine if moderate amounts of manure 20 tons/acre) can be disposed of without damaging the quality of runoff water or soil properties. Field experiments were conducted in Alabama for a 3-year period (1970-73). Rates of dairy cattle manure of 10 and 20 tons/acre incorporated into the surface 6 inches of soil had no detrimental effect on soil properties. Millet and rye forage produced were of good quality. When application rates exceeded 20 tons/acre, forage was high in No_3-N and had K: (Ca+mg) ratios that could be detrimental to animal health. When high manure rates were used, Dothan soil produced rye forage with higher NO_3-N contents than did Lucedale and Decatur soils, but millet forages produced on Decatur soil had No_3-N contents as high as on Dothan soil. Manure application rates of 40 tons/acre and above produced tetany-prone forage having K: (Ca +Mg) ratios above the 2.2 critical level, except for rye on Decatur soil. The quality of forage produced was found to be the limiting factor in rate of manure application rather than adverse effects of manure on soil properties or plant growth. Incorporating dairy cattle manure at the rate of 20 tons/acre into the top 6 inches of Norfolk sandy loam for 3 consecutive years had little effect on the No_3-N or Nh_4-N concentration of runoff water or on soil properties. (Merryman-East Central)

4533-A11, B3, C2, E3
OBSERVATIONS CONCERNING THE USE OF CATTLE MANURES IN DRYLOT FEEDING

Research Assistant, Department of Animal Science, University of California, Davis, California
C. L. Ferrell and W. N. Garrett
12th Annual California Feeders' Day, University of California, March 23, 1973, p. 4-11. 7 tab., 22 ref.

Keywords: Refeeding, Cattle manure, Minerals, Cattle, Performance, Lignin.

A study was conducted to determine the effect of continued refeeding of cattle manure to cattle. Also studied was the possibility of deleterious build-up of substances in the manure. The experiment was conducted on five successive feeding periods. In period I, four yearling Hereford steers were fed a basal ration at maintenance level. The steers' wastes were collected, dried and then mixed (50:50) with the basal ration for subsequent use in period II. The same procedure was used for periods III and IV. During period V the four steers were again fed the basal ration at maintenance level to determine any carry-over effects from period to period. Results showed no harm in mineral build-up in the feces from continuous recycling to animals fed manure as 50 percent of the ration dry matter. Indigestible components in the feces appeared to dilute the mineral excretion to less than harmful concentrations. The results suggested that there is some nutritive value in manure. Recycling within a feedlot without a rapid build-up of minerals of lignin seems possible. (Rowe-East Central)

4534-B1, C2
URINARY ALLANTOIN EXCRETION AND DIGESTIBLE DRY-MATTER INTAKE IN CATTLE AND BUFFALO

CSIRO Division of Animal Production, Tropical Cattle Research Centre, Rockhampton, Q, 4700, Australia
J. E. Vercoe
Journal of Agricultural Science, V. 86, p. 613-615, June, 1976. 1 fig., 12 ref.

Keywords: Diets, Allantoin, Cattle, Urine, Buffalo, Digestible dry-matter intake, Nucleic acids.

A linear relationship between the amount of allantoin excreted in the urine of cattle and the digestible dry-matter intake, has been found for cattle fed different roughage diets. The relation was also linear for buffalo although they excreted less urinary allantoin than cattle at the same level of digestible dry matter intake. It is postulated that the relationship arises because of the contribution that degraded microbial nucleic acids make to the excreted allantoin in the urine of cattle. (Copyright 1976 - Journal of Agricultural Science)

4535-A7, A11, B2, C3, D3, E1
SURVIVAL OF PATHOGENS IN FEEDLOT WASTE

Department of Veterinary Clinical Sciences, College of Veterinary Medicine, University of Minnesota, St. Paul, Minnesota 55101
S. L. Diesch
Proceedings of the Illinois State Veterinary Medical Association, 92nd Annual Convention, Feb. 18, 1974, 13 p. 13 ref.

Keywords: Pathogenic bacteria, Cattle wastes, Feedlots, Disease transmission, Animal health. Leptospires, Salmonella, Survival time, Measurement, Aerosols, Feed contamination.

A research project was designed to determine the survival of pathogens (leptospires and salmonella) in animal manure disposal by the oxidation ditch. Research objectives of the first 3 years were to measure leptospiral survival time, to develop and improve bacteriologic methods of measurement for detection of pathogens and for measurement of their survival in beef cattle manure in the laboratory model oxidation ditch during simulated field environmental conditions at summer and winter temperatures and to evaluate potential health effect of pathogens in cattle manure. Research objectives during the last 2 years were to determine the viability and infectivity of leptospires and salmonella in aerosols caused by potential mechanical dissemination of a laboratory model oxidation ditch, to determine the viability and infectivity potential of leptospires and salmonella in feed recycled from oxidation ditch manure, to monitor selected aerosols generated during aerobic treatment of animal manure from an oxidation ditch being used to treat beef cattle waste under a confinement housing unit, and to determine the relationships between temperature, loading rates and degradation of manure in an oxidation model ditch. Leptospires seeded for 5 days in a laboratory mdoel oxidation ditch survived 18 days at winter temperature (2-5°C) and for 138 days at summer (20°C) temperature. Hamsters were not infected by aerosolized transmission of salmonella or through consumption of contaminated feed. Salmonella survived for 17 days post seeding in the model oxidation ditch slurry at summer temperatures. Winter survival was 47 days. Turkey poults were infected when exposed to *Salmonella typhimurium* at 10^4 and 10^6 bacteria/liter of air. The poults were also infected by application of *Salmonella typhimurium* suspensions to eyes, nose or mouth. Salmonella contaminated recycled feed also caused salmonella infection. It is evident that epidemiologic research should be conducted on farms that have outbreaks of disease such as leptospirosis and salmonellosis. Proper waste management for animal disease prevention, control, and eradication must be a part of a total herd health program. (Merryman-East Central)

4536-B2, B5, E2
FARM PROGRESS SHOW . . . MORE CATTLE AND LESS WORK WITH CONFINEMENT

Anonymous
Wallaces Farmer, V. 102, No. 17, p. 148-149, Sept. 10, 1977. 2 fig.

Keywords: Confinement pens, Cattle, Management, Feeding, Liquid wastes, Waste storage, Land application, Corn.

Maurice and Dennis Crawford have a confinement system that blends together these important features: a 72 x 168-ft. confinement barn; a liquid manure system comprised of a slotted floor, pits, and additional storage to hold waste for a year; and automated feeding that allows individual feeding of pens according to size. One man handles the 450-head confinement operation. The Crawfords inject the liquid manure into the soil with a 3200-gallon applicator once a year in the fall. The fertilizer value of this manure has been proven with yields of 150 to 180 bushels of corn/acre on a 40-acre plot. The Crawfords get good gains (2½-3 lb/day) on range steers consuming a ration of high moisture shelled corn, corn silage and alfalfa silage. Feed is moved from storage by auger to belt-type centerline feeders in the confinement building. This system allows the Crawfords to choose any ration mixture to feed to the individual pens. (Bates-East Central)

4537-A11, B3, E3
DRIED CATTLE WASTE CAN STRETCH SWINE RATIONS

Anonymous
Southern Hog Producer, V. 8, No. 5, p. 19, Oct., 1977.

Keywords: Refeeding, Swine, Diets, Performance, Dried cattle wastes.

Research by Tennessee animal scientists has shown that a basal swine ration of 16 percent crude protein, fortified, corn-soybean-meal-tankage ration, plus up to 20 percent dried cattle wastes can produce satisfactory gains. However, swine rations including 30 and 40 percent wastes had an imbalance, deficiency, or excess of some nutrient factor that reduced swine performance. Swine rations containing no dried cattle wastes and those containing either 10 or 20 percent cattle wastes yielded daily gains of between 1.9 and 1.6 pounds for each pig. The pigs weighed 46.7 pounds at the beginning of the experiment and were fed to market weights. (Bates-East Central)

4538-A6, A10, B2, F1
FOR THIS HOG FARMER . . . NEW PORK PRODUCTION UNIT ELIMINATES WASTE DISPOSAL

C. Bice
Southern Hog Producer, V. 8, No. 5, p. 26, Oct., 1977. 2 fig.

Keywords: Swine management, Confinement pens, Flushing, Costs, Fly control, Odor control, Lagoons.

A new pork production unit which eliminates waste disposal was constructed this year on the Charles Edwards Farm. Under the direction of Marcus Oswalt, Swiss-American Management Corporation and Harlan Pigg, farm manager, the new unit of buildings to handle the 132 sows on the farm included a modern system of flushing to remove wastes from the farrowing houses, nursery, and feeding pens. Assistance in the planning and design for the system was provided by William C. Chisholm (Monroe County agent), Lee Miller (agricultural engineer), Mississippi Cooperative Extension Service (MCES) and Dr. James Shannon (MCES livestock specialist). Dr. Shannon explained that the flushing system involves two methods of removing waste from the facility: (1) open-gutter flushing, which is used in finishing and open concrete lots; and (2) under-slat flushing, which works best in farrowing, nursery and gestation confinement buildings. Advantages of flushing as compared to conventional systems include: (1) lower initial costs than slatted type system; (2) fewer fly problems, (3) elimination of much of the odor problem and (4) keeping pens and buildings cleaner. The wastes are flushed for treatment to a two-stage lagoon. (Bates-East Central)

4539-B3, C2, D1, E3, F2
MCANALLY TURNS OUT A UNIFORM HIGH-QUALITY DPW

R. C. Hartman
Poultry Digest reprint, p. 194-197, May, 1976. 4 fig., 1 tab.

Keywords: Refeeding, Dried poutlry wastes, Fertilizer, California, Regulation, Uniformity.

Since 1974, McAnally Enterprises, Yucaipa, California, has produced more than 8000 tons of DPW (dried poultry wastes). The DPW is used for livestock feed and fertilizer. Initially, there was reluctance on the part of feedlot operators to purchase the feed product, but now the demand has exceeded the supply, according to Carl Logfren, vice president of McAnally Enterprises. Except for an occasional sample, the McAnally product has met or exceeded the California state regulations for refeeding DPW. The uniform high quality of the DPW is attributable to three things: (1) The manure goes into the dryer in less than 24 hours after being produced. This practice also solved the fly problem. (2) Use of low heat with a high volume of air processing helps retain the nutrient values while destroying all organisms at the same time. (3) Close control over what goes into the poultry rations is exercised by the McAnally production manager and the nutritionalist. All feed-grade McAnally DPW is marketed by H. V. Nootbaar and Co., Capistrano Beach, California. (Bates-East Central)

4540-A3, B1, C2, E2
MANURE VS. ANAEROBIC RESIDUE

Bio-Gas of Colorado, 5620 Kendall Ct. #G, Arvada, Colorado 80002
Bio-Gas of Colorado
Manure Vs. Anaerobic Residue, Bio-Gas of Colorado, 3 p. 2 tab.

Keywords: Animal wastes, Anaerobic residues, Chemical properties, Land spreading, First year availability, Nitrogen, Volatilization, Agricultural runoff.

Describing manure composition is like hitting a moving target. From time of manure defecation until several days after the manure spreading, the manure loses 48 percent of the nitrogen it contained when fresh, primarily through ammonia volatilization and runoff. The manure and the soil to which the manure or residue is eventually applied contain bacteria which decompose protein-containing materials to the plant available forms of nitrogen (NH_4 and NH_3). Warm temperatures and alkaline conditions cause large amounts of free ammonia (NH_3) to be released. The percent of nitrogen in the form of protein which is converted by bacteria to Nh_4 or NH_3 forms of nitrogen is called first year availability. Organic nitrogen from manure is about 50 percent first year available while residue is approximately 30 percent first year available. (Merryman-East Central)

4541-A3, B1, C2, D3
NITROGEN REMOVAL AND TRANSFORMATIONS IN THE OVERLAND FLOW TREATMENT OF POULTRY WASTES

D. M. Covil
Ph.D. Dissertation, Department of Biological and Agricultural Engineering, North Carolina State University, 1976, 157 p. 48 fig., 2 tab., 43 ref.

Keywords: Waste treatment, Overland flow, Poultry wastes, Nitrogen losses, Ammonia, Volatilization, Denitrification, Soil sorption, Microbial assimilation, Agricultural runoff.

Overland flow as a treatment mechanism for the removal and/or conversion of nitrogen forms in poultry waste was studied over a six-month period for three terrace systems. The differences among the three systems were in nitrogen loading rates, hydraulic loading rates, and frequency of application. The major route for nitrogen mass losses for all systems is shown to be through the "unaccounted for" pathways which include ammonia volatilization, denitrification, soil sorption, and microbial assimilation (49 percent to 78 percent mass removal). Wastewater runoff accounted for 7.5 percent to 38 percent nitrogen mass removal with grass assimilation accounting for 4.8 percent to 11 percent. The mass loss of nitrogen by rainfall runoff (less than 2 percent) and soil water (less than 3 percent) were shown to be small relative to other pathways. The major form of nitrogen removal was through losses of ammonia nitrogen for all systems (68 percent to 75 percent concentration reduction at the 15 meter flow distance and 76 percent to 91 percent concentration reduction at the 30 meter flow distance). Terraces receiving "high" hydraulic loading rates were shown to be incapable of organic nitrogen concentration reduction at the 15 meter flow distance after 12 to 16 weeks of operation. Concentration reduction for the terrace system receiving a "low" hydraulic application rate (and "low" nitrogen loading rate) approximated 20 percent to 40 percent at the 15 meter flow distance and 50 percent to 70 percent at the 30 meter flow distance for the same time period. All terrace systems were more efficient in organic nitrogen concentration reduction during the first half of the study (40 percent to 50 percent at the 15 meter flow distance and 60 percent to 70 percent at the 30 meter flow distance) than during the last half. Nitrification potential for all systems is shown to be high for the first 2 to 4 weeks of operation (prior to the onset of constant saturated soil conditions) with a drastic decline following this period. *Nitrobacter* and *nitrosomonas* populations reached 10^5 to 10^7 for this early period with nitrate nitrogen concentrations in the wastewater runoff reaching values of 30 mg/l to 80 mg/l over the first 15 meters of flow. (Covil-North Carolina State University at Raleigh)

4542-A11, A12, B1, C2, E2
ARSENICALS IN ANIMAL FEEDS AND WASTES

Biological Waste Management Laboratory, Agricultural Environmental Quality Institute, Agricultural Research Service, Department of Agriculture, Beltsville, Maryland 20705
C. C. Calvert
Reprint, ACS Symposium Series, Number 7, ARSENICAL PESTICIDES, American Chemical Society, 1975, p. 70-80. 10 tab., 23 ref.

Keywords: Arsenicals, Feed additives, Animal health, Public health, Tissues, Feces, Land disposal.

In summary, arsenicals are used as feed additives to promote growth in poultry and swine as well as to treat specific diseases of these species and appear to have an established role in modern livestock and poultry production. The responses in general are small but may represent the difference between a profit and loss to the animal producer. Arsenic can be detected at low levels in tissues of animals receiving arsenicals. However, this arsenic is rapidly eliminated when arsenicals are removed from the feed for the required 5-day period. This process appears to be well regulated, and there does not appear to be a hazard to the consumer from arsenic in edible animal tissue. The arsenicals appear to be largely excreted unchanged in chemical structure with no toxic metabolites produced and with no evidence of the conversion to inorganic forms of arsenic in the animal. Because arsenicals are excreted for the most part in feces, no evidence is available to indicate that the amounts of arsenic that might be incorporated into soils by the disposal of animal wastes would constitute any problem with regard to plant growth or ultimately to arsenic contamination of consumer products. (Calvert-USDA)

4543-A5, B2, B4, C2, E2
GROUNDWATER LEVELS AS AFFECTED BY SWINE WASTE LAGOONS IN HIGH WATER TABLE SOILS

O. T. Bucklew, Jr.
M.S. Thesis, Virginia Polytechnic Institute and State University, July, 1976, 102 p. 11 fig., 2 tab., 17 ref.

Keywords: Anaerobic lagoons, Groundwater pollution, Swine wastes, Virginia, Ammonia, Chlorides, Heavy metals, Leaching.

The pollution hazard from anaerobic lagoons was examined. The study involved 2 lagoons in Southeast Virginia that had heavy concentrations of ammonia, chlorides, and heavy metals, which could cause contamination of water supplies. One lagoon was located at the Virginia Polytechnic Institute and State University Tidewater Research and Continuing Education Center at Holland Station, Virginia, and the other was located on a private farm near the Holland Station. Two series of wells were installed at each lagoon and groundwater levels were recorded. The water table was then plotted to determine the presence or absence of a groundwater mound around the lagoon, which would indicate seepage from the lagoon. A statistical analysis was used to evaluate the significance of temporal and spatial variations of the water table. Study findings indicated that: (1) Based on the data collected, there were no significant water table changes that could be attributed directly to seepage from the lagoons. (2) Many variables affected the profile of the water table in the vicinity of the lagoon which made an evaluation of the water table levels more difficult. (3) There was an indication of independent groundwater movement around the lagoons. (Merryman-East Central)

4544-A11, B3, C1, C2, E3

NUTRIENT CHARACTERIZATION OF SWINE FECAL WASTE AND UTILIZATION OF THESE NUTRIENTS BY SWINE

M. R. Holland
M.S. Thesis, Virginia Polytechnic Institute and State University, June, 1975, 74 p. 20 tab.

Keywords: Refeeding, Swine wastes, Swine, Performance, Nutrients, Raw wastes, Dried wastes.

Swine feces collected from finishing hogs were fed in 2 total collection metabolism trials to 48 crossbred gilts averaging 125 kg. Unprocessed feces were used in one trial and dried feces were used in the other. Feces from the gilts fed the feces-substituted rations were significantly higher in crude fiber, crude protein, ether extract, magnesium, copper, and zinc in both trials. Fecal concentration of ash, NFE, calcium, phosphorus, and potassium remained fairly constant. Phosphorus was the only urinary mineral which significantly increased as the level of feces refed increased. Fecal output increased as the amount of feces refed increased, but there were no differences in urinary output. Nutrients in swine feces were shown to be considerably less available than those in a corn-soybean meal ration. The economic practicality of refeeding swine fecal wastes was not determined. (Merryman-East Central)

4545-A7, B2, E1

EVALUATION OF A FLUSHING-GUTTER MANURE-REMOVAL SYSTEM TO IMPROVE ATMOSPHERIC QUALITY IN HOUSING FOR LAYING HENS

R. L. Fehr
Ph.D. Dissertation, Department of Agricultural Engineering, Iowa State University of Science and Technology, 1976, 152 p. 45 fig., 27 tab., 86 ref.

Keywords: Caged-layer houses, Poultry, Waste management, Flushing gutters, Air quality, Power requirements, Labor, Economics, Lagoons, Aeration, Temperature, Solids, pH.

A flushing-gutter, manure-handling system installed at the Poultry Research Center at Iowa State University was studied to see if it was capable of providing a productive environment for poultry without a large investment of capital or large labor requirement. Overall, the system functioned well, although minor mechanical failures occurred sporadically. Results yielded the following conclusions: (1) At low concentrations of ammonia nitrogen in the flush water, atmospheric ammonia is absorbed by the flush water, thereby reducing atmospheric-ammonia concentrations in the building. (2) Excessive aeration of the flush water during passage through the building should be avoided because the resulting high pH levels inhibit ammonia absorption. (3) The flush trays provide the main area for ammonia exchange between the flush water and the atmosphere, because of the air velocity over the water during flushing. (4) In this study, the flush-water temperature was direcity related to the building-air temperature. (5) Atmospheric-ammonia concentrations remained low throughout the test, indicating that a productive environment was being provided. (6) Ammonia-nitrogen concentrations in the lagoon water increased during the winter, which reduced the ammonia-absorption capacity of the flush water. (7) With the overflow from the drinking troughs entering the flush water, most water-quality concentrations remained constant; while without overflow, they increased linearly with time. The pH values did not follow this pattern but equilibrated to 7.3 with overflow and to 8.0 without. (8) Conductivity was highly correlated with most other water-quality measurements, except pH. (9) Approximately 88 percent of the solids flushed from the trays settled in the recycled water-storage area. (10) Solids concentrations in the flush water, which were less than .5 percent, did not noticeably affect manure removal from the trays. (11) Flushing frequency has a greater affect on manure removal than flush volume. (12) The flushing approach to manure handling in caged-layer houses has low operating power requirements, low labor needs, and the capital investment in equipment is low. (13) At present, flushing systems are only feasible if the manure can be treated biologically in a lagoon or sequence of lagoons. (14) Flush systems offer the potential of greatly increased stocking density because units can be stacked vertically. (15) Flush tanks for poultry should be designed with the discharge at the upper end of the trap so that the trap-charging hole can be eliminated. (Merryman-East Central)

4546-A2, B1, C1, C2

INFLUENCE OF SURFACES ON POLLUTION FROM FEEDLOTS

Department of Agricultural Engineering, Colorado State University, Fort Collins, Colorado 80523
R. A. Kidd
M.S. Thesis, Colorado State University, Fall, 1976, 74 p. 16 fig., 7 tab., 20 ref.

Keywords: Feedlot surfaces, Agricultural runoff, Runoff quality, Physical properties, Chemical properties, Slopes, Manure mantle.

This research was concerned with the pollution potential of runoff from feedlot surfaces where the manure was periodically harvested. Previous research had been conducted for more conventional feedlot conditions, however, the problem presented by utilizing high quality manure from the feedlot pen surfaces had not been studied. To evaluate the runoff pollution potential of feedlots managed for manure recycling, a series of tests using rainfall simulation was undertaken. Basically, the tests involved applying water through a sprinkler to simulate rainfall and collecting runoff for water quality analysis. Both the quantity and rate of runoff were measured. Runoff from each test plot was sampled periodically for quality. Seven water quality characteristics were determined: settleable solids; volatile solids; inorganic solids; alkalinity; pH; biochemical oxygen demand; and chemical oxygen demand. This study indicated that surfaced feedlots result in more runoff and a higher pollutant concentration than unsurfaced feedlots. Approximately 1.5 times more runoff may occur from surfaced feedlots with roughly twice the pollutant concentration when compared to unsurfaced feedlots of equal surface area. If properly managed, a surfaced feedlot will produce less runoff and fewer total pollutants per animal on feed than an unsurfaced feedlot. (Kidd-Colorado State University)

4547-B2, E2, F1

AN ANSWER TO MANURE DISPOSAL PROBLEMS

A. J. Dickens
Reprint, Tasmanian Journal of Agriculture, p. 60-61, Feb., 1974.

Keywords: Tasmania, Spray irrigation, Land application, Equipment, Costs, Australia, Dairy wastes.

Paul Griffin of Sisters Creek, Tasmania solved his manure disposal problem by spreading liquid effluent from his dairy onto nearby pasture with a minimum of effort and cost. First, Griffin installed a dual purpose pump that could be used as a washdown pump and a manure pump. This was accomplished by closing 2 valves and opening 2 others. Then a 5500-liter capacity pump was built which would carry the liquid manure in 2 sections of polythene pipe to the pasture for spray irrigation. The irrigation spray head that was used could be shifted to the end of either section as required. The sprayer was put together from materials around the farm. Although it does not spread as widely as some of the commercial sprayers, its cheapness and trouble-free operations more than compensates for the extra shifting it needs. (Bates-East Central)

4548-A8, B2, C2, D1, E2, F1

EFFLUENT DISPOSAL, A PILOT STUDY AT CRESSY RESEARCH STATION

R. J. Davies
Tasmanian Journal of Agriculture, p. 193-197, Aug., 1976. 6 fig.

Keywords: Swine wastes, Tasmania, Australia, Piggeries, Effluent, Land disposal, Crop response, Chemical properties, Soil properties, Collection pit, Agitation, Odor, Sprinkler irrigation, Costs.

A study was conducted where raw untreated pig waste was applied as slurry to pastures or crops. The objectives of the study were to provide guidelines on: (1) the minimum land area required, for a given pig population, to withstand repeated applications of pig waste without causing damage to pasture or soil, (2) the quantity of slurry produced as related to herd size, (3) fertilizer content of the slurry as related to herd size, (4) pH of the material (acid or alkaline), and (5) how waste applied to land affects soil fertility, soil pH and pasture growth and composition. Pig buildings at Cressy Research Station in Tasmania have solid floor dung passages. They are washed regularly with a high pressure hose. The hosing moves the dung to an outside circular concrete collection pit or sump. The sump is emptied several times a day. The sump is equipped with a simple agitator which ensures that solids that have settled since the previous emptying are brought back into suspension before pumping begins. When the sump is full, a float switch is used so that agitation and pumping start automatically. The basic equipment needed is: circular concrete sump, agitator and small electric motor, slurry pump and motor float switch gear, irrigation line, and knocker sprinkler. Results show that: (1) Smell is minimal with slurry removed daily from the piggery. (2) Application of the piggery waste has increased pasture growth.

(3) The pump and 2.23 kW motor are adequate to move effluent over 1,000 meters and discharge it through a sprinkler, and (4) The equipment is relatively cheap. It can be bought for less than $10 per pig housed. (Rowe-East Central)

4549-A6, B2, B3, B4, C1, C2, D1, D2, D3, E2, F1

EFFLUENT STORAGE AND DISPOSAL FROM INTENSIVE PIG UNITS

R. J. Davies
Reprint, Tasmanian Journal of Agriculture, p. 17-25, Feb., 1973. 9 fig.

Keywords: Swine wastes, Waste storage, Waste treatment, Waste disposal, Tasmania, Australia, Piggery, Effluent, Flushing, Aerobic treatment, Anaerobic treatment, Land disposal, Irrigation, Solid wastes, Liquid wastes, Drying, Composting, Incineration, Biochemical oxygen demand, Economics.

R. J. Davies, Piggery Officer, considers intensive pig units and lists several methods of storing, treating, and disposing of waste effluent and the problems associated with each. Piggery effluent consists of pig dung and urine, bedding material (if used), waste food, hair, washing-down water, and additional water from leaking drinkers and/or rain. Effluent can be stored in 2 ways -- as a solid by using straw and a composting technique or as a liquid. Storing effluent in a solid state is limited to cereal-growing districts because elsewhere the cost of straw would be prohibitive. The system is also restricted to pig houses of a certain design. Other solid management alternatives are drying and incinerating. Liquid effluent and disposal systems include: (a) Effluent is held in the pig house, either under the floor or absorbed in deep litter. The waste then has to be removed and disposed of on the land. (b) Manure is flushed daily from the pig house into a temporary holding tank from which the effluent is pumped by an irrigation system to the land. (c) Manure flushed from the pig house goes to an aerobic pig/tank or pond. The treated effluent is applied to the land by pumping or carting. (d) Flushed waste is first partially treated in an anaerobic pond and then is transferred to an aerobic pond with eventual disposal on the land. (e) Wastes are treated by an in-house oxidation unit with slatted floors and an aeration rotor to supply oxygen and circulate ditch contents. The effluent is flushed to a holding tank from which it is disposed on the land. (f) The waste is separated into solid waste and liquid waste. The solid material is transferred directly to land. The liquid is subjected to anaerobic or aerobic treatment before being disposed of through an irrigation system. Difficulties presented by effluent volume, and mechanics of moving effluent to the land will depend on farm location. No system in itself is adequate to reduce effluent BOD to a level suitable for discharge into a stream. Reductions of BOD can be achieved and pumping ability can be improved, but a low-cost system to control effluent problems has yet to be developed. (Bates-East Central)

4550-B2

SIPHON ... A METHOD OF MANURE DISPOSAL

J. D. McRoberts
Reprint, Tasmanian Journal of Agriculture, p. 147-148, Aug., 1975. 3 fig.

Keywords: Dairy wastes, Collecting tank, Design, Tasmania.

A simple but effective means of manure disposal is being used by Mr. H. Ball on his dairy property at Yarra Creek, King Island. He has a manure collecting tank measuring 900 x 500 x 700 mm with 'V' shaped base. A 50 mm polythene pipe is connected to the outside to remove the effluent. On the inside of the tank, a 50 mm galvanized iron free moving bend is fitted to the outlet pipe. A 50 mm galvanized iron pipe with a bevelled end is fitted to this bend. Two P.V.C. floats support the suction pipe. The siphon procedure is as follows: The holding yards are washed down with water from the storage tank, the manure collecting tank fills up, the float lifts the suction end of the siphon just above the outlet level, and effluent then siphons down the pipe. A quantity of clean water should follow the effluent to rinse out the drain pipe. This prevents the manure from hardening and blocking the pipe. (Bates-East Central)

4551-A3, A8, B1, C2, E2, F2

LAND DISPOSAL OF ANIMAL MANURE IN THE RED RIVER VALLEY

Department of Agricultural Engineering, University of Manitoba, Winnipeg, Canada R3T 2N2
D. D. Schulte, M. B. Tokarz and G. C. Bergson
Paper No. NCR 76-401, Manitoba Region Canadian Society of Agricultural Engineering and North Central Region American Society of Agricultural Engineers, 1976 Joint Meeting, Winnipeg, Manitoba, Canada, Sept. 30 and Oct. 1, 1976, 14 p. 2 fig., 3 tab., 14 ref.

Keywords: Canada, Livestock wastes, Land disposal, Red River Valley, Regulation, Pollution, Snowmelt runoff, Leaching, Salt accumulation, Phosphorus, Manitoba Clean Environment Act.

In Manitoba, the Clean Environment Act contains the principle pollution control regulations affecting livestock production. Three regulations govern the manner in which all Manitoba farmers must manage their manure: (1) Manure can only be spread on land where an agricultural crop will be grown within 16 months and harvested within 30 months of the time when spreading occurred. (2) Manure storage structures must keep the manure on the land and prevent leaching and surface runoff. (3) Spillage of manure on public roads is prohibited. The Act provides its administrators the power to set limits on discharge of materials not only from point sources such as feedlots and farmsteads, but also from cropland used for manure disposal. Similarity of climate, terrain and soils which characterize the Red River Valley cause many of the problems faced by livestock farmers in the Valley to be of the same fundamental nature. Solutions to the problems of long-term storage of manure, winter-spreading, and wet or otherwise inaccessible fields will probably have application throughout the entire Valley. Information is becoming available with which to assess the environmental impact of existing manure disposal practices. However, it will require several years of additional work to provide the necessary data with which to base future regulations and guidelines. (Merryman-East Central)

4552-B1, F1

FIT FLOOR TO YOUR SWINE OPERATION

Anonymous
Wallaces Farmer, V. 102, No. 18, p. 72-73, Sept. 24, 1977.

Keywords: Swine, Confinement pens, Slotted floors, Slat materials, Spacing, Life expectancy, Costs.

Art Muehling, agricultural engineer at the University of Illinois, discusses types of slotted floors in terms of slat materials and slat spacing. Farrowing slats must be spaced narrow enough (0.375 in.) to keep pigs from getting their feet caught between slats or wide enough (0.75 in.) so they can pull their feet out if they do get caught. Spacing behind the sows should be one inch, but the spacing should be covered with a grating for 48 hours after farrowing. Any slat width is acceptable here as long as the spacing is right. Nursery and growing-finishing pigs are more comfortable where slats are parallel to a pen's long dimension. Stainless steel is gaining popularity for farrowing units. For growing and finishing pigs, concrete slats are probably the best because uniformity of spacing is not as critical and because concrete usually lasts longer and costs less. Advantages of the different slat materials are as follows. Wood slats have the lowest initial cost and are warmer than most materials and good for baby pig areas. They last 2-5 years. Flattened expanded metal has worked well for farrowing and pigs under 50 lbs. Its estimated lifetime is 5-7 years. Expanded metal made of lower grade stainless steel has a 6-8 year life expectancy. Steel slats come in several thicknesses. Some are coated with epoxy or porcelain. Steel will last 5-10 years. Thicker or stainless steel slats have a longer life. Aluminum slats are uniform, lightweight, and smooth for easy cleaning and reduced abrasion. But they can be noisy. Plastic and fiberglass slats are lightweight and noncorrosive, but they are weaker than metal or concrete and need more support. While plastic and fiberglass slats have proved slippery, manufacturers are trying to correct this problem. Plastic and fiberglass have not been tested enough to determine life expectancy. Concrete slats are the most popular. They should last 10-15 years. Several kinds of commercial concrete slats are available -- prestressed slats, precast with reinforcement rods, gang slats, or pallets with built-in slats. (Merryman-East Central)

4553-A8, B2, B5, C2, E2

GET MORE VALUE FROM HOG MANURE

J. Wiebel
Wallaces Farmer, V. 102, No. 19, p. 8, Oct. 8, 1977. 1 fig., 2 tab.

Keywords: Swine wastes, Confinement pens, Liquid wastes, Nutrients, Land application, Application rates, Nitrogen, Phosphate, Potash, Soil tests, Sampling, Fertilizers.

Ken Patterson, a hogman in Washington County, Iowa, participated in a study 2 years ago to find out more about liquid swine manure. In this study, Patterson determined that the value of swine manure lay in more than its nitrogen value. Swine manure is also a valuable source of phosphate and potash. Patterson, who has a 3000-head farrow-to-finish operation including confinement farrowing, nursery, and finishing buildings, applies 1000 gal/acre and covers about 800 of his 850 row crop acres each year. To make sure crops aren't shortchanged or fertilized too much, Patterson soil tests each field before applying the liquid hog manure. While cleaning out the pit, he also samples the manure at full, half empty, and three-fourths empty stages and keeps track of where it's applied so he knows exactly how much commercial fertilizer he needs to apply. Patterson has found that the best way to apply swine wastes is to cut down the manure application rate to get phosphate and potash more in line with soil requirements and then to supplement other nutrient needs with commercial fertilizer. Tables are given for average estimates of nitrogen, potash, and phosphate content of farrow wastes, nursery wastes, finishing wastes (pit over ½ full) and finishing wastes (pit less than ½ full). A table is also given which states that at pit depth of 6 ft., swine wastes are 6.30 percent dry matter, and have the following lbs. of fertility nutrients in 1,000 gals.: nitrogen - 54; phosphate - 16; potash - 24. At 3.3 ft., the pit contents are 12.87 percent dry matter, and have 62 lbs. of nitrogen, 31 lbs. of phosphate, and 29 lbs. of potash per 1000 gals. (Merryman-East Central)

4554-A6, B1, F2

LEGAL POINTERS TO HELP KEEP YOUR LIVESTOCK SMELLING LIKE ROSES

J. Wiebel
Wallaces Farmer, V. 102, No. 18, p. 16-17, Sept. 24, 1977.

Keywords: Feedlots, Odors, Legal aspects, Iowa, Livestock, Feedlot nuisance law, Department of Environmental Quality, Location, Management, Lagoons, Manure hauling.

Livestock odors are unavoidable, unpredictable, and difficult to control under the best of management. Even with Iowa's feedlot nuisance law and odor regulations developed by the Department of Environmental Quality, the feedlot owner can still get into trouble because of feedlot odors. The feedlot nuisance law protects livestock producers from nuisance suits brought about by new landowners who move in after a feedlot is established. To get that protection, current environmental and zoning regulations must be met. The law gives a grace period for compliance with new regulations passed at a later date. The feedlot nuisance law does not help the feedlot owner who wants to expand his operations, however. Regulations of the Iowa Department of Environmental Quality (DEQ) authorize local boards of health and/or DEQ to hold informal hearings to resolve odor complaints. However, the case can still be taken into court. Feedlot owners can try to protect themselves in the following ways: (1) Use good management techniques. (2) Locate feedlot facilities as far away as possible from neighbors and maintain control of a buffer zone, if possible. Locate operations at least a quarter mile away from rural neighbors. Locate anaerobic lagoons at least a half mile away. (3) Be a good neighbor. Avoid squabbles over little things such as fence lines or the neighbor's livestock getting into your cornfield. When cleaning out a pit or lagoon, warn your neighbors ahead of time and consider inviting them to a beef or whole hog barbecue to celebrate when the cleaning is finished and the odors have diminished. Another idea is to pay the neighbor's expenses for a family outing or overnight vacation on the days of manure hauling. (4) Don't cut corners on waste handling facilities if there's any danger that it will increase odors from the operation. A feedlot owner's best defense is to avoid a lawsuit by taking every possible precaution to minimize odors. (Merryman-East Central)

4555-A7, A11, A12, B1

PIT VENTILATION SYSTEM FOR SWINE BUILDINGS

R. A. Keller
B.S. (Undergraduate) Degree Thesis, Agricultural Engineering Department, University of Illinois, Dec. 14, 1973, 75 p. 9 ref.

Keywords: Ventilation, Confinement pens, Design, Swine buildings, Gases, Health.

This paper deals with the design of a ventilation system that will successfully exhaust all gases that evolve from anaerobic digestion in pits before they come into contact with the animals. These noxious gases (methane, carbon dioxide, hydrogen sulfide, and ammonia) produced in pits irritate swine and men, especially during the winter months when the ventilation rate is near or below the minimum. One objective of this project was to design a system that can evenly exhaust gases from underneath the pit-length slats. This controlled air movement would help remove moisture and diseases, control temperature at the slat surface, and provide an environment for optimum pig performance. All the equipment used for the testing of the system was acquired from the Agricultural Engineering Laboratory. The fan was a centrifugal-type, Chicago Centricooler, Model 13-1-102. The fan was driven by a DC motor wired to an AC-DC Variable Speed Converter, Model VS-225. Ranging from 0 to 100, the dial settings on the converter used were 50, 80, and 100. With these settings, the respective revolutions per minute of the belt driven fan, 910, 1100, and 1400, were checked by a stroboscope. The DC motor was a 0.5 horsepower Century Model DN-6-208146-02. At 1800 RPM, it was rated as pulling 5.03 amperes and 90 volts. The main part of the system to be designed was a four inch perforated polyvinyl chloride (PVC) sewer pipe. The perforated pipe had two rows of one-half inch holes that were spaced approximately 4.5 inches apart and 30 degrees up from the bottom on each side of the pipe. Nine lenghts of ten foot pipe were erected in the Agricultural Engineering Laboratory to simulate one-half the length of one pit in a swine finishing unit on the University of Illinois' Moorman Farm. Once the tests were completed, the following conclusions were drawn: (1) Although this system was designed for one certain building, its installation into any pit system can be accomplished, knowing the ventilation rate and the amount of materials. (2) The hole sizing and spacing can be determined by using these tests, procedures (recommendations) of others, and design charts for perforated ducts. (3) For this system the final hole area was 28.0 square inches for a rate of 151 CFM. This corresponds very closely to L. B. Driggers' recommendation of 20 square inches for every 100 CFM. (4) The uniform holes can be drilled using the same size drill bit. (5) Although the perforated PVC pipe does not work, solid PVC pipe can be used by drilling holes where needed. (Merryman-East Central)

4556-B2, B4

AUTOMATIC SYSTEM SCRAPES MANURE - AND WORK - AWAY

Agricultural Engineer, Minnesota Power and Light Company
P. Shea
Electricity on the Farm, V. 44, No. 7, p. 10-11, July, 1971. 4 fig.

Keywords: Dairy wastes, Minnesota, Confinement housing, Scraping, Waste storage.

Ed. Thoennes, Minnesota dairyman, spent 2 years planning the best possible manure handling system for the 75 cows in his 42 x 136-ft. free stall barn near Urbank. Eventually, Thoennes set up a 1½-ho. motor to power a towing chain moving a steel blade scraper down each of two 120 x 10-ft. alleys. Each scraper is 4 inches high and 10 feet long. The chain runs in a 4 x 4-inch slot which extends the length of each alley and across the ends to the barn to form a continuous loop. A time clock control turns the scraper motor on 12 times every 24 hours. Very little manure accumulates between scrapings. As the scraper travels the length of the alley, it pushes 20 to 40 gallons of manure through manure drops into two 10-foot-deep, 20 x 47-ft. tanks (which can hold 4 months' accumulation) at the end of each alley. Waste water from the milk house and milking parlor flows by gravity into the manure storage tanks. An automatic sump pump discharges the flushing water used in the milking parlor pit into one of the storage tanks. (Merryman-East Central)

4557-A4, A5, A6, A7, A13, B1, B2, B3, B4, E2, F4

WHAT TO DO WITH ANIMAL WASTES ... RECYCLING

R. L. Maddex
Electricity on the Farm, V. 44, No. 7, p. 6-9, July, 1971. 1 fig.

Keywords: Waste disposal, Water pollution, Odor, Air pollution, Aesthetics, Land disposal, Drying, Separation techniques, Waste storage, Stacking, Ponds, Lagoons, Aerobic conditions, Anaerobic conditions.

Livestock wastes contribute to or cause the three following types of pollution: (1) contamination of surface and ground water, (2) odor and/or air pollution, and (3) visual unsightliness. The 2 general methods of waste disposal are: (1) surface, and (2) bacterial decomposition. Perhaps the best solution presently available is a combination of bacterial decomposition and surface disposal that will provide good control of pollution to surface and groundwater, eliminate or minimize odors, and avoid the visible appearance of polluted land. Other methods of waste handling such as drying, separation of the solids by screens, or plowing down waste as it is distributed are really methods of processing which, at present, are not economically practical for the vast majority of livestock operations. Each method of manure handling has some characteristics that identify its benefits or limitations for an individual farm operation. The major characteristics are: (1) daily manure distribution, (2) farmstead storage – periodic distributions: (a) liquid manure storage, (b) stacking, (3) ponds or lagoons: (a) aerobic, (b) anaerobic. Two variations of the ponding or lagooning method that combat odor problems and/or reduce structure size are: (1) anaerobic lagoons with mechanical aerators. (2) retention basin (pond) plus lagoon. (Merryman-East Central)

4558-A6, B1, C1, C2, C3, D2, E2, E3, F1

HOW TO CLEAN UP AT THE RACES

School of Public Health, University of Hawaii, Honolulu, Hawaii
N. C. Burbank, Jr.
30th Annual Purdue Industrial Waste Conference, May 7, 1975, 17 p. 5 fig., 4 tab., 11 ref.

Keywords: Horse wastes, Race tracks, Waste management, Waste treatment, Pyrolysis, Odor, Energy, Soil amendments, Recycling, Economics.

The object of this research was to reduce the volume of horse manure accumulated at horse races and at the same time to render it innocuous and sterile, free of Clostridium welchii (perfringens) and its spores, in short to convert it to a stable product which could be used as a safe soil conditioner on or near the site at which it is produced. The process of pyrolysis was used because both anaerobic decomposition and composting do not destroy the Clostridium spores. The first stage of the study consisted of a determination of the characteristics of horse manure. The second stage was a series of pyrolysis runs to determine (1) the time of dessication, (b) the amount of gas generated, (c) the percentage of residue, (d) the character and amount of the condensate, and (e) the character of the residue. The residue or char was found to be acceptable as a soil conditioner, having good water retention properties and no objectionable odor. The condensate would burn with no odor. It was hoped that the process used would be self-sustaining, but excess heat is required continually. (Bates-East Central)

4559-A1, A8, B2, C2, E2, F1

A MODEL FOR ALLEVIATING FARM WASTE POLLUTION IN ENGLAND -- PART 1

S. L. Willetts
Environmental Pollution Management, V. 4, No. 6, p. 265, 267, 271, 273, Nov./Dec., 1974.

Keywords: Animal wastes, Model studies, England, Transport system, Manure bank, Pollution, Soil amendments, Fertilizers, Application rates, Nitrogen, Slurries, Costs.

The purpose of this report was to examine the feasibility of a transport system in England that would relieve the overabundance of animal waste and the pollution hazard associated with this excess in the West while at the same time improving the soil structure of the heavily fertilized East. The English county redistribution model was based on the successful operation of a similar system in the Netherlands in which the Dutch "manure bank" takes manure from regions of overproduction at a nominal charge to the producer and then sells it to regions of poor soil structure. The English model classified counties, based on agricultural statistics, are either arable, grass or mixed. A low mileage network of transporting the manure was then worked out based on the maximum application of 50-60 units N/acre as manure or slurry on grassland counties; 40 units manurial N/acre for arable counties; and 40-50 units N/acre as manure for the mixed counties. This model provides for the prevention of pollution by manure from intensive animal production regions, plus it benefits the arable East which has almost reached the maximum N fertilization limits using inorganic fertilizer. (Bates-East Central)

4560-A4, B2, B3, C2, D1, D2, E2, E3, F1

A MODEL FOR ALLEVIATING FARM WASTE POLLUTION IN ENGLAND -- PART 2

S. L. Willetts
Environmental Pollution Management, p. 13-16, Jan./Feb., 1975. 3 tab., 8 ref.

Keywords: Water pollution, England, Waste treatment, Waste disposal, Drying, Cattle wastes, Swine wastes, Farmyard wastes, Poultry wastes, Slurries, Refeeding, Soil amendments, Economics.

The purpose of this article was to demonstrate how the drying of wet manure from the western part of England may help in the solution of farm waste disposal problems. Several types of dryers were presented as follows: mechanical dryers (presses and centrifuges), heat dryers, flash dryers, drum dryers, ring dryers, fluid bed dryers, attritor dryers, and microwave dryers. The cost of producing the dry product for each of the above dryers, at optimum operation, will depend upon: (1) required final moisture content, (2) moisture content in input, (3) length of working day available, (4) capital cost of the machine, (5) fuel costs during operation (oil, gas, etc.), (6) power requirements (electricity), (7) supervisory staff requirements. Poultry manure, after drying, was found to be the best source for possible uses as a product. Cow slurry, pig slurry, farmyard manure, and sewage sludge were also tested. DPW makes an excellent fertilizer and soil conditioner. As a protein source, DPW is comparable to cereals so it could be used as a feedstuff. These possible uses are not met with much enthusiasm at present. Also, the bulk of manure causing problems in waste disposal is the wet cow slurry in the western regions, and as has been shown in this paper, this is uneconomical to dry. However, it was concluded that DPW is a saleable product and would contribute to the alleviation of water pollution. (Bates-East Central)

4561-B2, C1, C2, C3, D3

USE OF AN ACTIVATED SLUDGE PROCESS IN TREATING CHICKEN MANURE COMBINED WITH DOMESTIC SEWAGE

C. S. Shu
M.S. Thesis, University of Connecticut, 1972, 154 p. 23 fig., 18 tab., 110 ref.

Keywords: Poultry wastes, Waste treatment, Activated sludge, Sewage treatment plant, Anaerobic digestion, Physical properties, Chemical properties, Biological properties, Loading rates, Aerobic treatment, Anaerobic treatment.

The feasibility of disposing of chicken manure by discharging it into a municipal activated sludge plant during the night low-flow hours was investigated. The advantages of such a method would save land area and eliminate on-site treatment facilities and pollution problems. The laboratory plant was operated for 123 days, treating raw sewage only, before the sewage-manure ratios -- 20:1, 40:1, 80:1 and 100:1 -- were tested during the entire experimental period. The addition of manure at a 100:1 sewage manure ratio was found to be feasible because: (a) The effluent COD and S.S. from the 100:1 sewage-manure ratio test were the same as those of treating raw sewage only. (b) The anaerobic digestion of the sludge produced from the 100:1 sewage-manure mixture did not retard or upset the digestion process. The addition of sewage-manure mixture tended to increase the sludge volume index, mixed liquor suspended solids and pH of the aeration tank mixed liquor. The sewage-manure appeared to reduce nitrate and nitrite concentrations in the effluent. The addition of sewage-manure sludge into the digester tended to increase gas production, alkalinity, volatile acids and pH. The study showed that an activated sludge plant with a one million gallon per day flow should be able to treat in 4 hours during the night low-flows the manure produced by 17,000 chickens. (Rowe-East Central)

4562-C2, C3, D1, D2, D3, E3, E4, F1

CONVERSION OF ORGANIC WASTE INTO PROTEIN

Anonymous
Water and Waste Treatment, V. 17, No. 6, p. 20, June, 1974. 1 fig.

Keywords: Biological treatment, Organic wastes, Fermenters, Protein, Refeeding, Physical treatment, Chemical treatment, Microfungi, Bacteria, Yeasts.

The biological treatment of organic wastes using fermenters to produce protein is discussed. The single cell protein can be used as a high value feed supplement in intensive animal husbandry. The organic waste may require certain treatments before being introduced into the fermenter. Such treatments may include the addition of certain essential nutrients, or physical or chemical treatment. In the fermenter, a strain, or strains, of microorganisms metabolize the nutrients in the organic waste producing protein. Research is being done on using microfungi, yeasts, and bacteria as the microorganisms for use in the fermenter. Although batch fermenters are available, it appears that continuous fermenters are necessary for economic feasibility. It is concluded that the conversion of organic waste into animal feed supplements is no longer a matter of research and development, but a matter of organization, finance, and engineering. (Solid Waste Information Retrieval System)

4563-B2, C2, D3, E2, E3, F1

COWTOWN'S MANURE MEANS MEGAWATTS

J. Nice
High Country News, V. 9, No. 13, p. 3-4, July 1, 1977. 2 fig.

Keywords: Recycling, Bio-Gas, Methane, Lamar, Colorado, Cattle wastes, Feedlots, Feasibility studies, By-product recovery, Fertilizers, Economics.

Bio-Gas, a four-year-old, five-person firm, is completing feasibility studies on a methane digester for Lamar, Colorado. Lamar's city-owned utility can't get natural gas to run its brand new power plant. To convert Lamar's boilers to coal-burning would be expensive. Lamar's feedlots may be the answer. Manure from these operations, when converted to gas in an enclosed tank, could be used to fire the existing power plant. Lamar, with a population of approximately 7,500 has 40,000 cows at or near the city limits. It has manure available at $1.50 a ton and a manure hauling industry already established that could take on the extra task of hauling wastes from the methane digester back to the farmers' fields. Lamar's power plant, run by the Arkansas Valley Power Authority, has a once-through cooling system that produces 110 degree water at the rate of 15,000 gallons/minute. They pour that water back into the river. Bio-Gas sees the water as a perfect heat source of a digester. (Merryman-East Central)

4564-A11, B2, C2, E3

HIGH LEVEL ANTIBIOTICS IN A SWINE WASTE RECYCLING SYSTEM

Michigan State University, East Lansing, Michigan
E. R. Miller and E. C. Miller
Journal of Animal Science, V. 41, p. 321-322, 1975.

Keywords: Swine, Drinking water, Swine wastes, Recycling, Antibiotics, Performance.

Thirty-two lots of pigs were utilized in a 2 X 2 X 2 factorial experiment to test the influence of high level dietary antibiotics on growing or finishing pigs receiving fresh water or recycled waste as their only source of drinking water (see Miller et. al., JAS 39:186). An antibiotic combination was added to one-half of the diets supplying 110 ppm of chlortetracycline, 110 ppm of sulfamethazine and 55 ppm of penicillin. One-half of the lots were growing pigs averaging 20 kg initial weight and the others were finishing pigs averaging 70 kg initial weight. One-half of the lots across size of pig and level of dietary antibiotic treatments received fresh water while the other lots received recycled swine waste as their only drinking water. Weekly measures of weight gain and feed consumption were taken over a 5-week period. Antibiotics significantly improved rate of gain regardless of weight of pig or type of drinking water. Efficiency of feed utilization for gain was significantly improved in growing pigs receiving recycled waste as the sole source of drinking water depressed rate and efficiency of gain in growing pigs but tended to improve rate and efficiency of gain of finishing pigs. (Copyright 1975 - Journal of Animal Science; Abstract only)

4565-B1, C2, D3, E3, F1

THE MARVELOUS CHICKEN-POWERED MOTORCAR

B. Grindrod
The Mother Earth News, No. 10, p. 15-19, July, 1971. 8 fig.

Keywords: Recycling, Animal wastes, Methane, Methane-powered motorcar, Auto gas converter, Digester, Design, Economics.

Harold Bate of Devonshire, England has devised a way of producing automobile fuel from animal droppings. Bate developed a manure digester which converts waste materials into methane gas. Bate has found that the ideal mixture to be fed to the digester is 75 percent droppings (half pig and half chicken) and 25 percent straw. Methane resulting from this formula has a caloric value per liquid pound of 22,000 B.T.U. as compared to gasoline's 19,000, propane's 19,944 and butane's 19,680. The excreta-straw formula is first stacked into a compost pile, doused with water and left exposed to the air for a week of aerobic prefermentation. Then about 300 lbs. of the mixure is shoveled into a heavy steel container and sealed shut. A wait of 4, 5 or even 7 days -- depending on conditions -- is then necessary before fermentation of the first batch starts. If a little of the original mix is left behind as a starter, gas production will usually begin within 24 hours for all following batches. Maximum methane production will be achieved by maintaining a temperature of 85-90°F. Bate pumps the methane gas into ordinary high-pressure bottles for storage. A filter between the digester and the pressure bottle extracts the small quantities of phosphoric acid and ammonia that are present and the remaining almost-pure methane liquifies at a pressure of 1110 psi. It takes about one-half hour of steady pumping to fill a 32-pound bottle to capacity. A single filling of 300 pounds of manure in the digester will produce about 1500 cubic feet of methane. Bate invented an auto gas convertor, an attachment that fits between the methane pressure bottle and the car's carburetor that allows the cylinders of the engine to suck just enough methane -- and no more -- from the bottle as the fuel is needed. The only modification made on the engine itself was a simple tubular jet which was threaded into the choke tube of the carburetor before the throttle butterfly valve. The advantages of such methane production and use are: economy, pollution reduction, and longer life and reduced maintenance on the vehicle. (Rowe-East Central)

4566-B1, C2, D3, E3

GOBAR GAS: METHANE EXPERIMENTS IN INDIA

Anonymous
The Mother Earth News, No. 12, p. 28-31, Nov., 1971. 1 fig.

Keywords: Methane, Gobar gas, Recycling, Cattle wastes, Anaerobic digesters, Design.

The Gobar Gas Research Station has concentrated its efforts on generating methane gas from cow manure. At the station, Ram Bux Singh and his co-workers have designed and put into operation bio-gas plants ranging in output from 100 to 9,000 cubic feet of methane a day. The resulting gas has been analyzed to be 55-65 percent methane, 30-35 percent carbon dioxide, with some hydrogen, nitrogen and other traces. Its heat value is about 600 BTU's per cubic foot. About one cubic foot of gas may be generated from 1 pound of cow manure at 75°F. Gas production is described in terms of fermentation, temperature, acidity, carbon-nitrogen ratio, and percentage of solids. Central to the operation and common to all gobar gas plant designs is an enclosed tank called a digester. This air-tight tank may be filled with raw organic waste and results in gas generation and a final slurry. Differences in tank design are based mainly on the material to be fed to the generator, the cycle of fermentation desired, and the temperatures under which the plant will operate. The digesters may be continuously fed or batch fed. Some means of mixing the slurry in a digester is always desirable, though not absolutely essential. In a cold climate, the digester should be insulated. Gobar tanks built above ground must be made of steel to withstand the pressure of the slurry. Underground methane plants are less expensive to construct and are easier to gravity-feed. On the other hand, above-surface models are easier to maintain and, if painted black, may be partially heated by solar radiation. Instructions are given for an underground, single-stage, double-chamber plant designed to digest 100 pounds of manure every 24 hours - 5 cows worth - but may be scaled upward to construct a plant capable of producing 500 feet of gas per day. (Merryman-East Central)

4567-B1, C2, D3, E3

HOW TO GENERATE POWER FROM GARBAGE

Anonymous
The Mother Earth News, No. 3, p. 45-53, May, 1970. 9 fig.

Keywords: Methane, Anaerobic digesters, Livestock wastes, Organic wastes, Design, Gas storage, Recycling.

There are several basic factors which must be considered in constructing or purchasing a methane digester installation. These include: (1) Climate; (2) Single or multiple family installations; (3) Amount of wastes available; (4) Gas production; (5) Number and size of digesters; (6) Location of digesters, (7) Gas requirements and storage, and (8) Materials and costs. Decomposition and gas production are most rapid at about 95°F but are satisfactory at temperatures above 59 -68°F. Either single or multiple family installations can be built, the choice depending on whether the single family has sufficient manure and other wastes to operate a unit. A minimum single family installation should normally include a digester tank of about 4-5 m^3 capacity and a gas-holder of at least 2 m^3 capacity. Available wastes may include livestock wastes, human excrement, garbage, waste straw, cane stalks, or any other organic material. About 50 percent of the carbon theoretically available for gas production is converted into gas. A metric ton of waste usually yields about 50-70 m^3 of gas per digestion cycle, depending upon the proportion of organic matter and the carbon content of the waste. The number and size of individual digestion tanks varies with the amount of decomposable material available and the amount of gas desired. A minimum of 2, and preferably 3, tanks is recommended. A digestion compartment of 8 m^3 capacity has been found to be an efficient size. Digesters should be located near the source of manure and waste material to avoid excessive handling and transportation. For small installations, storage capacity for about one day's requirement of gas should be provided. The gas-holder may be circular or square and should be provided with a water seal to prevent escape of gas or admission of air. The weight of a floating cover of the gas-holder provides the gas pressure. Actual costs are not given for the digesters, but it is a fact that installation costs are reduced if the plant owner builds the plant himself. The digestion tanks and gas-holder base can be constructed of concrete or masonry. If masonry is used, the tanks should be lined with plaster to prevent leakage of gas or liquid. Instructions are given for building such digesters. (Merryman-East Central)

4568-B2, C2, E3, F1

NOW...ELECTRICITY FROM MANURE GASES

Anonymous
The Mother Earth News, No. 3, p. 44, May, 1970. 2 fig.

Keywords: Electricity, Energy, Recycling, Swine wastes, Gases, Fly control, Odor control, Costs.

Dr. George W. Groth, Jr. has developed a hog manure power plant. Dr. Groth makes a 10-kilowatt generator hum by capping a liquid manure pit to trap the ''sewer'' gas and trying it to a gas engine. Enough electricity is created to pump his ranch's water and to run the heat lamps for the baby pigs. A complete digestion cycle takes about 20 days, but once under way, the process is continuous. Side benefits of the system are fly and odor control. (Merryman - East Central)

4569-B1, C2, E3
POWER! HAROLD BATE AND HIS MARVELOUS CHICKEN-POWERED CAR

R. Chadwick
The Mother Earth News, No. 8, p. 9, March, 1971.

Keywords: Poultry manure, Recycling, Methane, Fuels, Chicken-powered car.

Harold Bate, a British farmer, produces methane gas by sealing 4 or 5 gallons of chicken manure in a drum and heating it to a constant 80 degrees with a small oil lamp. He collects the gas in bottles or plastic balloons through an exit valve and stores it for use. Bate heats his farm buildings and runs a five ton truck and his automobile on the gas. He claims that both car and truck run faster, cleaner and better on the methane which is sucked into the engine by the cylinders and ignited in the usual way. The conversion of a motor vehicle from gasoline to methane power is made by the installation of Bate's 6 x 5 inch patented carburetor attachment. Bate markets a complete conversion kit which includes the device, fitting instructions anyone can follow, and details and drawings for at-home methane production. (Merryman-East Central)

4570-A4, A6, A7, A10, B1, B5, C1, C2, C3, E2
GUIDELINES FOR MANURE USE AND DISPOSAL IN THE WESTERN REGION, USA

Imperial Valley Conservation Research Center, USDA-ARS, Western Region, 4151 Highway 86, Brawley, California 92227
B. Meek, L. Chesnin, W. Fuller, R. Miller, and D. Turner
Bulletin 814, Agricultural Research Center, Washington State University, 1975, 18 p. 10 fig., 21 tab., 50 ref.

Keywords: Western United States, Land application, Manure, Chemical properties, Physical properties, Biological properties, Water pollution, Odor, Dust, Flies, Salinity, Ammonia toxicity, Guidelines.

Although the variety of climates in the Western Region of the United States suggests a variety of techniques for pollution control and effective manure handling, the great proportion of manures are being recycled to the land as fertilizers and soil amendments. Guidelines for land application are given which will encourage the efficient use of manure in crop production. Physical, chemical, and biological properties of various types of manure are discussed. Water pollution in relation to land application of manure is discussed. Problems associated with overuse (salinity, ammonia toxicity, and oversupply of elements and trace elements) are examined. Guidelines are given for applying manure to warm irrigated regions (more than 6,000 annual degree days), to cold irrigated regions (less than 6,000 annual degree days), to dryland regions, and to humid regions. (Merryman-East Central)

4571-A11, B3, B4, C2, D3, E2, F1
A PLACE FOR POULTRY WASTE

Staff Editor, Feedlot Management
G. Lamp
Feedlot Management, V. 19, No. 12, p. 29, 32, Nov., 1977. 2 fig.

Keywords: Refeeding, Poultry litter, Waste storage, Ensiling, Corn silage, Cattle, Protein, Performance, Economics.

Ken Durensky has been making money, reducing his labor output, and seeing better gains since he started refeeding chicken litter to his cattle. The manure from his 12,000 chickens will sustain exactly 350 head of cattle. To collect the poultry waste, there are poultry scrapers beneath the chicken house cages that collect the waste and move it to an auger on the east side of the building. Then it is moved to an above ground waste storage facility to be used later in the ensiling process. The waste is later combined half-and-half by weight with oat or barley straw and stored in an oxygen-limiting silo for 28 days. Another oxygen-limiting silo stores corn silage that mixed half-and-half with the combination poultry waste product before being fed to cattle. The waste, before it is combined with straw, has 28 percent protein. After the 28-day fermentation period, it has 12-13 percent protein. The total cost of combining the chicken litter with straw is about $2/ton. Another $20/ton for corn silage is added. Overall the value of chicken litter as fertilizer is about $5/ton. Durensky feeds cattle twice a day, 8 lb/head each time, using a total of 3,000 lb. of feed per day. The cost of gain is roughly $10/head/day. Durensky feels there are no disadvantages in the entire system. (Rowe-East Central)

4572-B2, E2
IRRIGATING WITH WASTEWATER

J. R. Dawson
Confinement, V. 2, No. 8, p. 10, Sept., 1977.

Keywords: Wastewater, Land application, Equipment, Design, Performance.

Wastewater application is trickier than working with river or irrigation wellwater. Lindsay Company of Lindsay, Nebraska and Amarillo, Texas, two years ago, dealt with the problems of getting wastewaters through the nozzles. Towlines, center pivots and their Traveling Big Gun, a trailer-mounted volume gun with a separate hose cart, were adapted to handling the heavier liquids. The wastewater needs to be agitated from the start to keep the consistency uniform to avoid accumulation in bottom of pit and to keep the pivot from plugging up. The entire system should be flushed with pure water for 15 or 20 minutes after running the wastewater through it. In Papillion, Nebraska, L. P. Schram owns a 4000-head beef feedlot. He has used a 6-tower Lindsay center-pivot for 4 years. For collecting runoff from outside feedlot, he has an underground drainage system. On the way to the holding pond, the runoff goes through a debris basin, where most of the solids precipitate and are handled afterwards as "dry" manure. Schram applies about 1" of the wastewater at a time. He uses a 6" pipe from storage area to the pivot, which is 1300 feet to 1400 feet away. He uses a 60 hp PTO tractor to run pump and generator. Elmer Bohr, who manages a 5,000-head farrow-to-finish unit for Bill Curry near Atkinson, Nebraska, started 3 years ago with an Olson oil-drive center pivot unit. He found that with a 4" pipe there is too much friction loss when the water is traveling 1200 feet. He recommends using a 6" pipe. Flexibility is the key to Bill Wiese's 2,000-head farrow-to-finish operation near Wausa, Nebraska. He injects 50 gallons of wastewater per minute into a main line running 500 gallons of fresh water. His pits are 600 feet to 650 feet from the well. He uses an 8" main line. At the well with pressure at 125 psi, the liquids pass through 4,400 feet of main line and 650 feet of hose and arrive with an adequate 75 to 80 psi at the gun. (Rowe-East Central)

4573-A2, B2, B3, B4, C1, C2, E2
RUNOFF FROM A LOW-COST MANURE STORAGE FACILITY

Plant and Soil Science Department, University of Vermont, Burlington, Vermont
R. R. Magdoff, J. F. Amadon, S. P. Goldberg, and G. D. Wells
Transactions of the ASAE, V. 20, No. 4, p. 658-660, 665, July-Aug., 1977. 4 fig., 3 tab., 6 ref.

Keywords: Agricultural runoff, Waste storage, Solids, Nutrients, Irrigation, Land application, Manure stack.

Runoff from a low-cost manure storage facility was monitored for volume and quality. During the winter and early spring, runoff rates were high with 69 percent of the total runoff occurring during January through April. Only 26 percent of the annual percipitation occurred during these months. Monthly losses of solids and nutrients were correlated with volume of runoff. The annual loss of solids, N, P, and K in the runoff amounted to 82.0, 6.0, 0.4, and 8.3 kg/cow respectively. The results indicate that runoff from the facility should be contained and irrigated on cropland or the manure stack covered to prevent contamination of precipitation by contact with manure. (Copyright 1977 - Transactions of the ASAE)

4574-A8, B3, E2
EFFECTS OF FEEDLOT WASTES ON THE WATER RELATIONS OF PULLMAN CLAY LOAM

Department of Agronomy, Cornell University, Ithaca, New York
F. N. Swader and B. A. Stewart
Paper No. 72-959, American Society of Agricultural Engineers, 1972 Annual Meeting, Hot Springs, Arkansas, June 27-30, 1972, 12 p. 7 fig., 9 ref.

Keywords: Feedlot wastes, Land application, Application rates, Infiltration rates.

Investigations were conducted on two established experimental areas at the USDA Southwestern Great Plains Research Center, Bushland, Texas. One area had received annual feedlot wastes (FLW) applications of 0-, 10-, 20-, 50-, or 100-tons per acre (T/A) in 1968, 1969, and 1970. Treatments on the second area were annual applications of 0-, 10-, 30-, 60-, or 120-T/A of FLW in 1969, 1970, and 1971. Applications of FLW tended to increase the organic matter content of the plow layer and a thin zone directly beneath the plow layer. Three annual applications of 0-, 10-, 20-, or 50-T/A did not significantly increase the rate of infiltration into the plow layer, although there was a trend toward an increase. Infiltration rates of the B_{22t} horizon were increased by the application of FLW.

The water-holding capacities were not increased by applications of 30-, 60-, or 120-T/A of FLW. No differences were noted in the bulk densities of the plot layer. (Swader-Cornell)

4575-A8, B2, B3, B4, B5, C2, D1, E2, E3
MANURE DISPOSAL

J. T. Bruce
Reprint, Tasmanian Journal of Agriculture, p. 186-193, Aug., 1970. 5 fig.

Keywords: Poultry wastes, Solid wastes, Slurries, Land application, Drying, Potash, Phosphorus, Nitrogen, Waste storage, Tasmania.

Since the swing from deep litter to cages, poultry manure has become more difficult to handle than the once customary litter-manure mixture. Some producers advocate long-term disposal methods while others advocate short-term disposal methods. The long term is where the manure is removed only once a year. This can result in fly and vermin problems. The short-term method calls for the manure to be removed from the house at short intervals. Where manure is removed at short intervals, there are 2 main problems -- how to move the manure from the house and how to dispose of it afterwards. Manure can be moved either by hand or mechanically. One of the cheapest methods of disposal is to load the manure into a trailer-spreader and spread it directly on land near the poultry farm. Poultry manure may also be made into a slurry to be disposed of through an irrigation system. Usually, droppings to be converted to slurry are removed by gravity to a tank below ground or mechanically to a pit outside the building. Water is then added to produce a slurry with a solids content low enough to permit its removal by a pump or by a special vacuum tank on wheels. Advantages of slurry irrigation include: (1) Low labor cost of disposal. (2) Ability of spray during wet weather. (3) Low capital cost. Disadvantages include: (1) Reduction to 8 percent solids, for irrigation purposes, by water means frequent emptying. (2) Less satisfactory in dry weather because applications may make the pasture unpalatable. (3) Difficulty in reaching all parts of the farm. There is increasing interest in the prospect of drying poultry manure, bagging it and selling it to gardeners and horticulturalists. Points to remember concerning land application of poultry manure are: (1) It tends to be low in potash. (2) Heavy applications will burn grassland due to its nitrogen content and often slow down the development of cereals. (3) It will cause rapid loss of lime from the soil. (4) The continuous use of poultry manure results in a high ratio of available phosphorus to potash. Because of this, a dressing of sulphate of potash is desirable every 2-4 years. (5) Poultry manure is ideal for cabbage, kale, and mangolds. (6) Part of the nitrogen is liberated quickly, so it is good as a rapid-acting top dressing. The remaining nitrogen is released slowly, giving prolonged nitrogen activity. On many farms, daily disposal of fresh manure cannot be achieved satisfactorily, and some means of storage becomes necessary. The simplest type of building will do for storage. It should have a concrete base, concrete walls on 3 sides extending up to about 2 feet from the roof, and an asbestos roof mounted on poles. (Merryman-East Central)

4576-A11, B1, F1
HOUSING AND EQUIPMENT: OPTIONS FOR CONFINEMENT HOUSING

University of Nebraska, Lincoln, Nebraska
S. Farlin and C. Gilbertson
Feedlot Management, V. 18, No. 12, p. 36, 38, 40-41, Nov., 1976. 4 fig., 1 tab.

Keywords: Confinement pens, Housing, Cattle, Waste management, Performance, Costs.

Factors to be considered before deciding that confinement feeding is the best choice to make in raising cattle are: (1) What is the actual advantage of confinement facilities for beef feeding in your particular operation? (2) How many turns of cattle are fed per year? (3) What is the long-term climatic trend? (4) What unique advantages or disadvantages does the confinement facility offer your particular operation in terms of animal performance or waste management? (5) What options for confinement housing are actually available to your operation? A housed feedlot is a physical plant consisting of several subsystems: animal environment and feed, water, animal and manure handling. Several components make up these subsystems. The animal and environment subsystem determines the other subsystems used. The climatological pattern determines the type of housing selected. The floor and pen arrangement also contribute to the animal environment. Floor type determines how the manure is to be removed from the animal environment. Manure management can be divided into 3 categories: liquid handling, slurry handling, and solid handling. Liquid handling is common to flush systems using holding ponds. Slurry systems are common to the slotted floor, deep pit system. Solid handling is common to bedded floors or where hydraulic or mechanical separation of solids is used. Choice of manure handling system should be based on labor availability, systems management, environmental problems, animal performance, and economics. Minimum initial costs for construction of housed feedlots for a minimum of 1000 head will range from $100 to $160 per animal unit. The 4 basic housed feedlot types are: (1) An open front building with concrete floor, gutter cleaner and a storage bunker. (2) An open front house with slotted floor and deep pit, using a tank wagon for field distribution, (3) An open house with partial slotted floors using a tank wagon for field distribution, and (4) A house with a flush type floor and manure holding pond. For much of the country, confinement housing is difficult to justify on the basis of improved animal performance alone. (Rowe-East Central)

4577-B2, B5, C2, E2
MICROFLORA OF NEWLY CUT GRASS AFTER ADDITION OF LIQUID MANURE

Department of Microbiology, Agricultural University of Norway, N-1432 Aas-NLH, Norway
T. A. Pedersen and D. M. Guttormsen
Acta Agriculture Scandinavico, V. 25, No. 4, p. 337-345, 1975. 2 fig., 6 tab., 19 ref.

Keywords: Liquid wastes, Farm wastes, Land spreading, Microflora, Ensiling, Saccharolytes, Proteolytic anaerobes, Fecal streptococci.

An investigation was conducted to determine how spreading of liquid manure on grassland in the spring or after a harvest would affect the composition of the microflora of grass harvested later the same year. Influence of different methods of manure distribution (high, low, band, and sub-surface) and the height of cut on the microflora of newly cut grass was examined. The test organisms selected were among those which could be expected to cause malfermentation in a grass silo. With all spreading methods the tendency was for increased numbers of test bacteria to be found when the stubble heights were lowered. With low stubble, spore forming anaerobes were especially numerous in grass harvested from plots receiving low and subsurface application of liquid manure. The viability of these organisms was preserved relatively well in the soil, especially in the case of proteolytic anaerobes. Saccharolytes, however, decreased markedly in numbers with the prolonged stay in the soil. Both of these anaerobic bacterial types constitute the greatest danger to initiation of satisfactory conditions for ensiling. Extremely high numbers of fecal streptococci were found in some cases of the grass harvested, but these organisms are not expected to have a harmful effect upon ensiling. (Merryman-East Central)

4578-A11, E3
SWINE FECES RECYCLING IN CARPS FEEDING

G. C. Albuquerque, E. J. Campos, S. S. Cavalcanti, and I. B. M. Sampaio
Arquivos da Escola de Veterinaria, V. 26, No. 2, p. 147-152, 1976. 4 tab., 10 ref.

Keywords: Refeeding, Swine wastes, Carps.

In this experiment it was studied the effects caused by replacement of ration for growing pigs by feces of these same animals aiming the feed of carps. There was a total of sixty-four fish distributed in 8 groups of 8 fish each. Treatments consisted in replacing the pigs ration for 25, 50 and 75 percent of feces respectively, being the control animals fed with ration only. At the end of these 245 day experiment, the weight gain of the groups fed with ration only, did tend significantly to be greater than the remaining groups. (Copyright 1976 - Arquivos da Escola de Veterinaria) (Article in Portuguese)

4579-B2, C3
THE EFFECT OF THE MICROFLORA IN CATTLE SLURRY ON THE SURVIVAL OF *SALMONELLA DUBLIN*

Institute for Research on Animal Diseases, Compton, Newbury, Berkshire, England
P. W. Jones, G. S. Smith, and J. Bew
The British Veterinary Journal, V. 133, No. 1, p. 1-8, Jan.-Feb., 1977.

Keywords: Cattle wastes, Slurries, *Salmonella dublin*, Survival rates, Microflora, England.

Experiments were performed to study the growth of *S. dublin* in sterilized slurry and to assess the effect of the microflora in slurry on the survival of *S. dublin*. *S. dublin* multiplied in sterilized slurry and subsequently survived for more than 370 days. In natural slurry or in sterilized slurry to which bacteria originally isolated from slurry were added, no such multiplication was observed and *S. dublin* survived for shorter periods. Thus, survival of *S. dublin* appears to be influenced by competition with normal microbial slurry flora and by the production of acid compounds toxic to *S. dublin*. (Merryman-East Central)

4580-A8, B5, C2, C3, E2
EVALUATION OF ORGANIC MANURES

R. Milnes-Coates
The Soil Association, V. 1, No. 6, p. 4-6, Sept., 1973. 4 ref.

Keywords: Farm wastes, Land application, Crop response, Nutrients, Unit-values, Phosphorus, Potassium, Nitrogen.

Bulky organic manures (BOM) seem to benefit both the humus content of the soil and the soil population, thus improving fertility. BOM's are variable in quality. Different BOM's are suited to different crops. Because it is characteristic of BOM's that only a part of the plant food is immediately available and that the remainder is released gradually, it is important to know how much value remains in subsequent years so that this can be taken into account. Organic farmers are much handicapped by having so little information on organic manuring backed by proper experimental work. This results either in wasteful overmanuring or in underestimating the amounts required by the crops. Objections to this kind of recycling of manure that may be raised are: (1) That such work will encourage factory farming by making it easier to deal with manure disposal problems. (2) That the contamination of some BOM's (Copper in pig slurry, antibiotics, hormones, and pesticides in Deep Litter and heavy metals in Municipal sludges and composts) makes them unsuitable as organic manures. (3) That the whole idea of unit-values of plant food is against Soil Association principles of feeding the soil and not the plant. It would be an advantage to organic farming if research was carried out into how far the unit system of NPK evaluation is suitable for deciding the types and amounts of organic manures to be used in the growing of farm crops by organic methods. (Rowe-East Central)

4581-A6, D1, D2, D3, F1
VARIED RESULTS FROM HOG PIT DEODORIZERS

Anonymous
Wallaces Farmer, V. 102, No. 20, p. 41, Oct. 22, 1977.

Keywords: Odor control, Chemical treatment, Masking agents, Odor counteractants, Enzymes, Digestive aids, Absorbents.

Confinement livestock producers are urged to experiment with several small quantities of manure pit deodorizers before investing heavily in any one product. There are 4 types of pit deodorizers to choose from: (1) masking agents, (2) odor counteractants, (3) digestive aids (enzymes or bacterial cultures), (4) absorbents (similar to kitty litter). Little scientific research has been done, to date, to verify the effectiveness of these products. Three disadvantages of most products are the high cost, unpredictable results and the fact that they offer only short term solutions to odor problems. Persistent odor problems might be cut down by keeping animal pens cleaner along with proper storage and pumping of wastes. (Bates-East Central)

4582-B2, B3, C2, E3, E4
GLEANINGS FROM REPORTS AT THE RECENT MEETING OF THE AMERICAN SOCIETY OF ANIMAL SCIENCE

Anonymous
Confinement, V. 2, No. 7, p. 16, July-Aug., 1977.

Keywords: Recycling, By-product recovery, Refeeding, Cattle wastes, Swine, Swine wastes, Algae.

A number of informative reports were presented at a recent meeting of the American Society of Animal Science. Two of the reports related to recycling livestock wastes. It was reported that dried cattle waste can be used up to a certain amount in the ration of growing-finishing swine. Gains drop off with too heavy substitution. Six University of Tennessee animal scientists established that a basal ration of 16 percent crude protein, fortified, corn-soybean-meal-tankage ration plus up to 20 percent dried cattle waste product produced satisfactory gains. However, swine rations including 30 percent and 40 percent waste had an imbalance, deficiency, or excess of some nutrient factor that reduced the performance of the growing-finishing swine. A report concerning research done at Oregon State University established that algae grown on swine manure at Oregon State University proved to be roughly equivalent to soybean meal in protein and other values. Peter R. Cheeke, animal nutritionist, fed the algae to rats in a series of tests. Cheeke determined that the problem with growing and harvesting the algae is economical. It was necessary to treat the algae with heat to break down the cell walls of the algae to make the protein available to the animal. (Rowe-East Central)

4583-A6, C2
ANALYTICAL AND ORGANOLEPTIC MEASUREMENT OF ODOURS FROM ANIMAL WASTES

Agricultural Engineering Department, The Ohio State University, Columbus, Ohio 43210
White, R. K.
Proceedings, International Symposium on Identification and Measurement of Environmental Pollutants, Ottawa, Ontario, 1971, p. 105-109. 5 fig., 14 ref.

Keywords: Odor, Sampling, Equipment, Gas chromatography.

The control and abatement of odour nuisances requires correlating subjective evaluations, i.e., organoleptic or sensory measurements, with objective analyses, i.e., qualitative and quantitative measurements. Equipment and techniques have been developed for representative sampling of odours at ambient temperatures, for analytical measurement of the odorants using gas chromatography and for organoleptic evaluations. A representative sampling technique utilizes packed bed samplers which collect odorants in proportion to their concentration in the air sampled. After the sample is collected at ambient conditions, it is transferred to a cryrogenic trapping device for injection into a gas chromatograph. Injection is performed mechanically to assure repeatability. A stream splitter in the gas chromatograph, separating part of the sample for sensory evaluation, enables analytical and organoleptic measurements to be made for the same fraction. An evaluation of the equipment and techniques indicates that a correlation of analytical and organoleptic measurements was obtained. Improvements of existing equipment for sampling, injection, and analysis of odorous samples are presented. New and improved techniques to include panel studies on odour intensities, for both field and laboratory samples, are discussed. (White-The Ohio State University)

4584-B5, C3
RELATIONSHIPS BETWEEN COPROPHILOUS FUNGI AND FECAL SUBSTRATES IN A COLORADO GRASSLAND

Department of Biology and Pymatuning Laboratory of Ecology, University of Pittsburgh, Pittsburgh, Pennsylvania 15260
K. Angel and D. T. Wicklow
Mycologia, V. 67, No. 1, p. 63-74, 1975. 1 fig., 4 tab., 25 ref.

Keywords: Colorado, Grassland, Coprophilous fungi, Fecal substrates, Cattle, Rabbits, Pronghorn.

A survey was made of the kinds of fungi which developed fructifications on different coprophilous substrates from a semiarid grassland in Colorado. Fifty-three species were found on approximately 650 g dry weight of feces. These included cattle feces (37 specis/600 g), rabbit feces (27 species/30 g), pronghorn feces (17 species/20 g), and small-mammal feces (12 species/1 g). Given the relatively small amount of substrate examined, and the fact that collections came from adjacent pastures, the population of coprophilous fungi was remarkably diversified. Populations on ruminant feces (cattle and pronghorn) were most similar in species composition, while those on pronghorn and small-mammal feces showed the least similarity. Many of the species sporulated on both freshly dried and partially decomposed cattle droppings during moist-chamber incubation. Some of the problems associated with attempts at quantifying populations of coprophilous fungi are considered, and hypotheses explaining the apparently high diversity of species in this grassland are discussed. (Copyright 1975 - Mycologia)

4585-A2, A4, A8, C2
MONITORING AGRICULTURAL POLLUTION USING NATURAL FLUORESCENCE

Saskatchewan Research Council, Saskatoon, Saskatchewan, Canada
G. Lakshman
Water Resources Research, V. 11, No. 5, p. 705-708, Oct., 1975. 9 fig., 1 tab., 7 ref.

Keywords: Feedlot wastes, Sampling, Fluorescence, Total carbon, Total organic carbon, Total inorganic carbon, Water quality, Agricultural runoff.

A remote sensing technique which uses the natural fluorescence of feedlot pollutants to monitor their presence was studied. Solid and water samples were taken from several feedlots in Saskatchewan to determine if animal manure exhibited natural fluorescence strong enough to be used in a monitoring technique. Water extracts of these samples were prepared and filtered to eliminate suspended material from the final sample. By using an Aminco-Bowman spectrophotofluorometer, the fluorescence of the sample was analyzed. A strong correlation was found to exist between the fluorescence emission and the water quality parameters such as total carbon (TC), total organic carbon (TOC), and total inorganic carbon (TIC). The technique was found to be versatile enough to be used on land and in water. Pollutants from the feedlots were found to exhibit a strong fluorescence of several orders of magnitude greater than the fluorescence from a 10-ppb Rhodamine dye. Future research should help to exploit the technique for remote sensing applications. (Rowe-East Central)

4586-A6, B2, D1, D2, D3, E2, F1
ADDITIVES FOR MANURE ODOR CONTROL

H. L. Brodie
Cow Moos, p. 8, Sept.-Oct., 1977.

Keywords: Odor control, Land application, Biological treatment, Chemical treatment, Masking agents, pH, Economics.

The best odor control technique is to remove manure from animal facilities frequently and apply the manure to the land by incorporation into the soil. Liquid spreading equipment that produces a spray should not be used because it increases manure contact with the atmosphere and therefore causes a greater odor problem. By pH control or by biological conversion, the volatile compounds present in the feed or manure may be converted to a nonvolatile form. This can be done by addition of a pH adjusting chemical, by a controlled biological operation, or by addition of a chemical known to convert the chemical of concern into a less volatile one. Other odor control methods are prevention of anaerobic decomposition by drying, aeration or oxidation by mechanical equipment, and addition of chemicals toxic to bacteria. Odor control chemicals and materials have been tried and tested, but no research has been able to find one or a combination of substances which is clearly capable of satisfactory odor removal. The cost of application varies. Thirty dollars per cow per year is an estimate. Chemical substances and masking agents may be less or more expensive, depending on the particular compound. (Rowe-East Central)

4587-A8, B3, C2, C3, D3, E3
COMPOSTING CONVERTS WASTE INTO VALUABLE RESOURCES

L. Chesnin
Farm, Ranch and Home Quarterly, V. 24, No. 3, p. 19-21, Fall, 1977. 3 fig., 2 tab.

Keywords: Composting, Feedlot wastes, Paunch manure, Sewage sludge, Crop residues, Chemical properties, Physical properties, Fertilizers.

Leon Chesnin, Associate Professor of Agronomy at the University of Nebraska at Lincoln, has done research on the possibilities for composting feedlot manure, paunch manure, sewage sludge and crop residues. It was found that the concentrations of nitrogen, phosphorus, potassium, sulfur, and zinc in beef cattle manure are increased or concentrated when this waste is composted and that bulk tonnage and percentage of moisture is greatly reduced. Sewage sludge is also greatly reduced in moisture content when composted, although if it contains more than 90 percent moisture, it must be mixed with drier, bulky mass (such as crop residues) for proper composting. Composting eliminates excess moisture, bad odor and the associated fly problem. With all the sources studied, composting the material resulted in an excellent fertilizer and soil amendment. In the case of sewage sludge, composting would save communities substantial sums with the elimination of the need for sewage treatment plants. Although there isnt's enough organic waste available for recycling to replace commercial fertilizers, composting material would greatly benefit the soil productivity and increase available moisture. (Bates-East Central)

4588-A8, C2, E2
ON THE INFLUENCE OF MANURE AND FERTILIZERS ON THE DISTRIBUTION AND AMOUNTS OF PLANT-AVAILABLE Cd IN SOILS

A. Anderson
Swedish Journal of Agricultural Research, V. 6, No. 1, p. 27-36, 1976. 4 tab., 15 ref.

Keywords: Land application, Manure, Fertilizers, Soil analysis, Cadmium, Sweden.

This paper is a contribution to the evaluation of the effects of fertilizers on the Cadmium (Cd) levels in soils and plants. Cd analyses of farmyard manure indicated that normal application rates of manure give an annual input of 1-4 g of Cd/hectare. This gave researchers a base line figure with which to gauge the Cd levels in the soil from chemical fertilizers contaminated with Cd. Four different commercial fertilizers were treated at three different rates and analyses were carried out on soil and plant material from these experimental plots. The plant material analyzed was wheat grain. Increased Cd content of the grain was found to correspond with increasing fertilization rates. Since this was attributed to soil chemical reactions rather than the Cd content of the fertilizers, only the fertilizer with the highest Cd level (919 ug/g) was felt to affect the Cd level of the grain. The distribution of Cd between soil particles and equilibrium solution as a function of the concentration of fertilizer salts was studied in laboratory experiments. It was shown that the Cd concentation of the equilibrium solution could be increased also in the case of almost Cd-free fertilizers due to soil chemical reactions brought about by the fertilizer salts. The fertilizer salts caused a drop in pH resulting in increased Cd solubility. A more important effect was direct ion exchange of Cd in the soil by the fertilizer cations resulting in increased Cd concentration of the equilibrium solution. According to the laws of ion exchange, some of the fertilizer Cd from contaminated fertilizers becomes absorbed to the soil particles, thus keeping the concentrations of the equilibrium solution lower than would be expected. (Bates-East Central)

4589-B1, C1, C2
PROPERTIES OF MANURE ACCUMULATIONS FROM MIDWEST BEEF CATTLE FEEDLOTS

Animal Science Department, University of Nebraska, Lincoln, Nebraska
C. B. Gilbertson, J. R. Ellis, J. A. Nienaber, T. M. McCalla, T. J. Klopfenstein
Transactions of the ASAE, V. 18, No. 2, p. 327-330, March-April, 1975. 4 fig., 4 tab., 11 ref.

Keywords: Feedlots, Cattle wastes, Slopes, Moisture content, pH, Electrical conductivity, Total solids, Nitrogen, Phosphorus, Midwestern United States.

Outdoor beef cattle feedlots were constructed with 3, 6, and 9 percent slopes in July 1968 at the University of Nebraska Field Laboratory to study the characteristics of wastes. Results of the nine cleanings for the period, July 1968 through October 1972, as follows: (1) The quantity and quality of material removed from outdoor feedlots were influenced by uncontrollable climatic conditions. (2) Slope did not have a predictable effect on the average moisture content of material removed. However, the moisture content (percent db) of waste removed from 9.3 m^2/head lots averaged 97.2 percent, compared with 82.6 percent for 18.6 m^2/head feedlots. (3) The pH of material removed from the 9.3 m^2/head lots averaged 7.6 compared with 6.6 for the 18.6 m^2/head lots. The electrical conductivity averaged 3.75 mmhos for all lots studied. (4) Total solids removed from 3, 6, and 9 percent surface-sloped feedlots with cattle at 18.6 m^2/head averaged 3.8, 3.4, and 3.1 metric tons/hectare day for 9.3 m^2/head feedlots. The total solids removed averaged 25 and 35 percent volatile for the 18.6 and 9.3 m^2/head lots, respectively. (5) The amount of soil removed during cleaning was estimated at 1.1 and 3.4 metric tons/hectare day on 18.6 and 9.3 m^2/head feedlots, respectively. (6) The quantity of N and P removed per metric ton of dry material averaged 13.5 and 0.9 kg, respectively. (7) The distribution of dry solids on 9.3 and 18.6 m^2/head lots varied with the cleaning period. The material was relatively uniform over the feedlot surface, although there was some accumulation near the feedbunks, waterers, and lower fence lines. (8) The specific gravity of material removed from the feedlot surface was 2.28. Specific gravity increased as particle size decreased. (9) The total solid decreased from 72 to 7 percent volatile for material retained on the 2000 and 37 micron sieves, respectively. Gross energy for the fraction retained on the 37 micron sieve was not measurable with equipment used. (10) Complete removal of material down to the soil-manure interface is not reommended because the large quantities of soil removed must be replaced. (Copyright 1975 - Transactions of the ASAE)

4590-A2, A3, A4, A8, B2, C2, E2
ANALYSIS OF RUNOFF FROM SOUTHERN GREAT PLAINS FEEDLOTS

Southwestern Great Plains Research Center, ARS, USDA, Bushland, Texas
R. N. Clark, A. D. Schneider, and B. A. Stewart
Transactions of the ASAE, V. 18, No. 2, p. 319-322, March-April, 1975. 6 fig., 7 ref.

Keywords: Feedlots, Agricultural runoff, Southern Great Plains, Salts, Irrigation, Holding ponds, Playas, Watersheds, Water quality.

Runoff amounts and chemical quality have been measured from a Southern Great Plains cattle feedlot at Bushland, Texas. The rainfall-runoff relationship for runoff-producing storms was linear, with about one-third of the rainfall in excess of 10 mm ending up as runoff. Other researchers in the Great Plains obtained similar results except that the amount of rainfall ending up as runoff was lower at Bushland. Concentrations of various runoff constituents were higher than those found for cattle feedlots elsewhere. Low rainfall, high evaporation rates, and high stocking rates cause the manure pack in the feedlots to contain more salts, thus allowing increased concentration sin runoff. A dilution ratio of about five parts well water to one part feedlot runoff would reduce the salinity hazard for irrigation from very high to medium for most holding ponds in the Southern Great Plains. Runoff caught in playas where the area of the feedlot is one-fifth or less of the total watershed area could be considered as having a low or medium salinity hazard. Any use of feedlot runoff for irrigation requires close watch on salts in the water and soil. (Copyright 1975 - Transactions of the ASAE)

4591-A2, A3, A4, A5, B1, B5, C2, F2

IRRIGATED AGRICULTURE: NONPOINT AND POINT SOURCE WATER POLLUTION

S. J. Hadeed
Journal Water Pollution Control Federation, V. 48, No. 9, p. 2116-2119, Sept., 1976.

Keywords: Pollution, Agricultural runoff, Point sources, Nonpoint sources, Leaching, Salinity, Water pollution, Feedlots, Environmental Protection Agency, Regulation, Irrigation, Crop production.

Irrigated agriculture results in point source pollution (discharges from any conveyance) and nonpoint source pollution (unconfined discharges). The primary cause of nonpoint source pollution is undefined surface runoff from irrigated agriculture. Nonpoint source pollution problems vary from region to region. In the West, leaching caused increased water salinity. In the Central States, feedlot runoff increases water nutrients. The Environmental Protection Agency (EPA) has recently proposed regulations to expand its permit authority over all point sources in concentrated feedlot operations, agricultural and silviculture. Agricultural nonpoint sources are still largely unregulated. The National Commission on Water Quality (NCWQ) has proposed to Congress a series of plants to control irrigation-related water pollution including salinity alleviation projects, better water delivery systems such as lined canals to minimize seepage losses during diversion, and better farm water management techniques such as tail water recovery or recycling to conserve supply and increase water-use efficiency. The EPA studies in the Upper Colorado River Basin show that cost-effective technology is rapidly becoming available to control pollution from irrigated crop production. (Denker-Florida)

4592-A8, E2

ADSORPTION OF POULTRY LITTER EXTRACTS BY SOIL AND CLAY

Department of Agronomy, University of Georgia, Athens, Georgia 30601
K. H. Tan, V. G. Mudgal, and R. A. Leonard
Environmental Science and Technology, V. 9, No. 2, p. 132-135, 1975. 5 fig., 1 tab., 17 ref.

Keywords: Poultry litter extracts, Soil adsorption, Kaolinite, Bentonite, Slopes, Temperature, Ionization.

Adsorption of the water-soluble fraction of poultry litter was investigated at constant temperatures using Cecil, Tifton, and Hayesville soils and kaolinite and bentonite as adsorbents. Organic matter extracts were characterized by infrared spectroscopy. The results indicated that broiler litter was adsorbed in almost similar amounts as layer litter extract by either soils or clays. However, degree of adsorption varied with types of clays as well as with soil series. The slope of the adsorption isotherms was steeper for bentonite than for kaolinite. For soils, the slope of the isotherms decreased in the following order: Hayesville > Tifton > Cecil. The adsorption isotherms were linear within the concentrations examined; the slopes decreased with increasing temperature from 25, 35 to 50°C. Protonated poultry litter extract was adsorbed in larger amounts than Na -saturated extract, indicating that ionic bonding might be involved, or that ionization of carboxyl groups was reduced. (Copyright 1975-Environmental Science and Technology)

4593-A6, B2, C1, C2, D1, D3, E2

TREATMENT OF WHOLE PIG SLURRY IN AN OXIDATION DITCH: STAGE 1

K. Robinson, editor
Waste Management Report 1/75, Bacteriology Division, North of Scotland College of Agriculture, Aberdeen, Scotland, Aug., 1975, 36 p. 31 fig., 4 tab., 6 ref.

Keywords: Scotland, Waste treatment, Temperature, Swine wastes, Oxidation ditch, Sampling, Chemical analysis, Nitrification, Screening, Solids content, Oxygen demand, Odor, Land application.

This trial was one of a series to be undertaken to determine whether loading rates postulated by the waste treatment group of the West of Scotland Agricultural College, using laboratory scale units, could be achieved under field conditions. The treatment unit used in the trial was a plywood oxidation ditch with a volume of 3,405 liters. Once the ditch was started by use of anaerobic lagoon liquor, 200 liters of slurry per day were dumped into the oxidation ditch via the channel immediately in front of the rotor. The source of this slurry was a 2,500-liter stirred tank mounted over one end of the ditch which was filled, once weekly, by pumping raw slurry from the collecting pit of a fattening house. Temperature ranged from -1 to 10°C. Random 0.5 liter samples were removed from the oxidation ditch at a point immediately in front of the rotor so that they were representative of the mixed liquor circulating in the ditch. Well-mixed samples of influent waste were removed from the slurry storage tank above the ditch. Analyses were performed regularly on the influent slurry and mixed liquor, and on their supernatants prepared by centrifugation at 2,800 x g/30 minutes. Parameters monitored were: solids, chemical oxygen demand, nitrogen, minerals, pH, conductivity, alkalinity, and dissolved oxygen. Study results indicated that: (1) Even at the low temperatures prevailing during the trial, loss of oxygen demand occurred. (2) Nitrification was inhibited by the low temperature and in the alkaline conditions coupled with high NH_4^+-N concentrations, there was a considerable loss of free ammonia by desorption. (3) Screening of husk material from the mixed liquor was very difficult due to the viscous nature of the liquor. (4) High solids levels in the input resulted in a high solids level in the mixed liquor/effluent and no settling. (5) Loss of 30 percent of the input nitrogen was unimportant since treatment, by lowering the oxygen demand, allowed more slurry to be spread per unit area. (6) Treatment had no effect on the concentrations of some elements such as potassium and phosphorus. This could result in over application if land application rates of the waste are calculated on the basis of its nitrogen content. The slurry had relatively little odor. However, the partially treated end-product of this trial turned anaerobic rapidly when stored, and it developed an unpleasant smell. (Merryman-East Central)

4594-B2, C1, C2, D1, D3

TREATMENT OF WHOLE PIG SLURRY IN AN OXIDATION DITCH: STAGE 2

P. J. Mills and D. R. Fenlon, editors
Waste Management Report 1/76. Engineering Division, North of Scotland College of Agriculture, Aberdeen, Scotland, 1976, 23 p. 13 fig., 2 tab.

Keywords: Scotland, Swine wastes, Waste treatment, Temperature, Oxidation ditch, Sampling, Chemical analysis, Solids, Oxygen demand, Nitrification, Screening, Denitrification.

The work described in this report is a repeat of the oxidation ditch trial documented in Waste Management Report 1/75. This new trial took place between June 27, 1975 and Sept. 7, 1975 with temperatures between 7 and 18°C compared with a range -1 to 10°C for the earlier trial. All other experimental parameters were kept the same. The rotor drive system for the oxidation ditch was made more reliable for use in the new trial. Anaerobic lagoon effluent was used to start the oxidation ditch. On July 28, 1975, 200 1/day of unscreened swine slurry was fed into the oxidation ditch. Analyses were performed regularly on the influent slurry and mixed liquor, and on their supernatants prepared by centrifugation at 2,800 x g/30 minutes. Parameters monitored were: solids, chemical oxygen demand, nitrogen, minerals, alkalinity, conductivity, and dissolved oxygen. Study results indicated that: (1) At the relatively high temperatures involved, the loss of soluble oxygen demand and effluent quality did not improve as much as might have been expected. The system should be loaded at higher rates in warmer weather. (2) Nitrification took place to quite an extent when the pH fell. The oxidized nitrogen formed was readily lost after mechanical failure and resultant low DO levels. (3) Increased loss of nitrogen will exacerbate the problems of mineral imbalance due to P and K if the material is used for land spreading. (4) At lower pH the liquor settles to give an effluent if required. This effluent, although relatively free of suspended solids, still has a high dissolved chemical oxygen demand and solids content, making it unsuitable for discharge. (Merryman-East Central)

4595-B2, D3

CONTROLLED ADDITION OF ANIMAL WASTE TO AEROBIC BIOLOGICAL TREATMENT PLANTS. A COMPARISON OF pH AND DISSOLVED OXYGEN CONTROLLED SYSTEMS

Bacteriology Division, School of Agriculture, North of Scotland College of Agriculture, Aberdeen, Scotland.
K. Robinson and D. Fenlon
Bacteriology Division Report No. 2/76, North of Scotland College of Agriculture, 1976, 20 p. 2 fig., 24 tab., 10 ref.

Keywords: Aerobic treatment, Fermentation, Swine wastes, Substrate addition, pH controlled systems, Dissolved oxygen controlled systems.

During the operation of two fermenters, substrate addition was used to maintain a mixed microbial culture at either pH 7.0 or 70 percent dissolved oxygen saturation. pH control was found to permit a greater volume of substrate to be processed. Ammonium nitrogen concentrations were similar for both fermenters but concentrations of oxidised nitrogen varied. Nitrification/denitrification sequences appeared to be initiated by unscheduled changes in dissolved oxygen concentration. It was possible to maintain a steady state with respect to a controlled parameter and end-product quality but other measured parameters fluctuated. (Robinson - North of Scotland College of Agriculture)

4596-B2, C2, D3, E3, F1

BIO-GAS PLANT GENERATING METHANE FROM ORGANIC WASTES

R. B. Singh
Bio-Gas Plant Generating Methane from Organic Wastes. Gobar Gas Research Station, Ajitmal, Etawah, India, 1974. 103 p.

Keywords: Methane, Bio-gas plants, Anaerobic digestion, Design, India, United States, Costs.

This book discusses bio-gas -- what it is and the practicality of using it. Background is given concerning the development of Bio-gas plants, especially their development in India. Bio-gas plants are discussed in terms of design, including design for both continuous feeding and batch feeding digesters. Descriptions of how to build 7 different Bio-gas plants are given. Approximate costs for installation in both India and in the United States are given for digesters that will produce 100 Cft gas/day, 250 Cft gas/day, 500 Cft gas/day, 1200 Cft gas/day, and 2000 Cft gas/day. (Rowe-East Central)

4597-B2, C2, D3, E3

ENERGY RECOVERY ON THE FARM BY ANAEROBIC DIGESTION OF ANIMAL MANURES

Department of Agricultural Engineering, University of Minnesota, St. Paul, Minnesota
P. R. Goodrich, N. J. Horvath, J. D. Nielsen, S. M. Kalis, K. L. Hauer, and V. Larson
Energy Recovery on the Farm by Anaerobic Digestion of Animal Manures, University of Minnesota, 1977, 28 p. 15 fig., 25 ref.

Keywords: Anaerobic digestion, Animal wastes, Anaerobic digester, Design, Performance, Electrode potential, Bio-gas production.

A field-scale anaerobic digester with a reactor volume of 44 cubic meters was monitored under field conditions. The apparent electrode potential (AEP) ranged from -380 millivolts during poor gas production to -485 millivolts during one peak in gas production. The apparent electrode potentials, however, didn't foretell problems with the digester such that they could be used for control of the digester without a much stronger correlation with digester performance. (Goodrich - University of Minnesota)

4598-A8, B2, B5, C3, E2

SOME BACTERIOLOGICAL CHANGES ASSOCIATED WITH THE APPLICATION OF COW SLURRY TO GRASSLAND

Department of Microbiology, The University of Reading, London Road, Reading, RG1, 5AQ, England
J. M. Grainger and A. H. Varnam
Journal of Applied Bacteriology, V. 37, p. 8-9, 1974. 2 ref.

Keywords: Cattle wastes, Slurries, Land application, Grassland management, Bacteriological changes.

Bacteriological changes were studies in soil and slurry in field experiments in which cattle slurry was applied to grassland in the month of March. In 2 experiments, which were performed in successive years, four application rates in the range 0-220 tons of slurry/acre were studied. In general, the magnitude of changes in soil microorganisms was correspondingly reduced for the plots receiving smaller amounts of slurry. The influence of the slurry on the soil flora was at a maximum in the period 6-10 weeks after slurry application, after which time the characteristics of the soil isolates began to return to normal. The differences in the soil and slurry isolates were in the distribution of dominant taxonomic groups and certain physiological features. Dominant bacteria in untreated soil were Gram positive irregular rods, mainly coryneform bacteria. Dominant bacteria in the slurry were Gram negative regular rods, mainly *Pseudomonas* spp. In comparing soil and slurry, the smaller proportions of isolates from the untreated soil were able to reduce nitrites and nitrates and hydrolyse urea. (Merryman-East Central)

4599-B2, C1, C2, C3, D1, D3

DENITRIFICATION OF AEROBICALLY STABILISED PIG WASTE

Bacteriology Division, School of Agriculture, King Street, Aberdeen, Scotland
D. R. Fenlon and K. Robinson
Water Research, V. 11, p. 269-273, 1977. 4 fig., 2 tab., 18 ref.

Keywords: Swine wastes, Liquid wastes, Aerobic treatment, Denitrification, Temperature, Effluent quality, Phosphorus, Solids, Chemical oxygen demand.

Experiments for the study of denitrification of biologically stabilised, nitrified pig waste are described. The rate of denitrification was increased by the addition of an energy source or by an increase in temperature. A supplementary energy source in field-scale stabilisation systems can be replaced by the residual chemical oxygen demand of a partially nitrified waste. A semi-continuous denitrification process was capable of reducing input inorganic N concentrations of several hundred mga to less than 50 mg1^{-1}. Denitrification also improved final effluent quality by reducing soluble phosphorus, total and dissolved solids and chemical oxygen demand. (Copyright 1977-Water Research)

4600-A2, A4, B2, C2

EUTROPHICATION POTENTIAL OF DAIRY CATTLE WASTE RUNOFF

Utah State University, Logan, Utah 84322
D. S. Filip and E. J. Middlebrooks
Water Research, V. 10, No. 1, p. 89-93, Dec., 1976. 6 fig., 13 ref.

Keywords: Cattle wastes, Dairy wastes, Feedlot runoff, Nutrients, Eutrophication, Algal growth, Water pollution, Toxicity, Nitrogen, Phosphorus.

Utilizing standard bottle test algal bioassays correlated with chemical analyses for growth limiting nutrients, the biostimulatory and chemical characteristics of dairy cattle waste runoff were evaluated. Comparisons were made between this very concentrated runoff collected from a concrete covered feeding area and runoff from beef cattle feedlots where runoff could only be sampled after much dilution by spring and stream waters. The dairy feedlot runoff was extremely rich in nutrients, and in very dilute concentrations it stimulated prolonged algal growth, indicating a strong pollution potential. In more concentrated solutions biostimulation was inhibited by toxicity which seemed indigenous to concentrated runoff water. Toxicity was found in beef cattle runoff in earlier studies. Topography and animal numbers differed between the dairy feedlot and the beef cattle lots precluding extracting comparisons. However, the chemical nature of the more concentrated dairy cattle runoff was consistent; whereas, the water chemistry of the more dilute beef runoff changed suddenly in response to changes in cattle density near the streams. (Copyright 1976-Water Research)

4601-A2, A3, A4, B2, C2

FACTORS AFFECTING NUTRIENT LOADS IN SOME IOWA STREAMS

Department of Animal Ecology, Iowa State University, Ames, Iowa 50010
J. R. Jones, B. P. Borofka, and R. W. Bachmann
Water Research, V. 10, No. 2, p. 117-122, 1976. 2 fig., 7 tab., 42 ref.

Keywords: Watersheds, Iowa, Water pollution, Nitrogen, Phosphorus, Nutrients, Runoff, Feedlots, Croplands.

The export and concentration of inorganic nitrogen and total phosphorus from 34 watersheds in a northwestern Iowa lake district were measured during March 1971-August 1973. Annual nutrient losses were approximately 0.35 kg ha^{-1} p. 6.7 kg ha^{-1} NO_3-N, and 1.0 kg ha^{-1} NH_3-N. A statistical analysis of the relationship between land-use and plant nutrients was used to determine differences among streams. Animal units in feedlots were significantly correlated with phosphorus and ammonia nitrogen (mg 1^{-1} and kg ha^{-1} yr^{-1}). Nitrate nitrogen was negatively correlated with the percentage of watershed in marshland. Tile drainage and surface runoff from grasslands, feedlots, cornfields, and soybean fields were analyzed for nitrogen and phosphorus in spring 1974; mean values are given. (Copyright 1976-Water Research)

4602-B2, C2, D1, D3, E3

TREATMENT OF POULTRY MANURE WASTEWATER USING A ROTATING BIOLOGICAL CONTACTOR

Green International Inc., 504 Beaver St., Sewickley, Pennsylvania 15143
A. P. Pajak and R. C. Loehr
Water Research, V. 10, No. 5, p. 399-406, 1976. 7 fig., 5 tab., 11 ref.

Keywords: Liquid wastes, Poultry wastes, Rotating biological contactor, Biological treatment, Chemical oxygen demand, Biochemical oxygen demand, Nitrogen removal, Effluent quality, Flushing, Spray irrigation.

A pilot scale, six stage rotating biological contactor was used to evaluate the feasibility of this process for the stabilization of liquid animal manures. Total disc surface area was approximately 16.7 m^2. Treatment efficiencies were determined at various waste strengths and influent flow rates. With loading rates of 14.7-322 g m^{-2} day^{-1}, the average COD reduction was 61 percent. With loading rates of 4.88-24.4 g m^{-2} day^{-1} the average BOD reduction was 87 percent. Total nitrogen removal averaged approximately 30 percent for the entire study. Mixed liquor oxygen uptake rates were generally in excess of 80 mg l^{-1} h^{-1}. Clarified effluent was non-odorous and suitable to be reused for manure flushing or spray irrigation. Treatment was not sufficient to permit effluent discharge to surface waters. (Copyright 1976-Water Research)

4603-A11, B2, C2, C3, D3, E3

ROLE OF RECYCLED LARGE ANIMAL WASTES FOR ANIMAL PROTEIN PRODUCTION

R. L. Vetter
ISU Nutrition Symposium on Proteins, June 7-8, 1972, p. 235-244. 8 tab., 22 ref.

Keywords: Liquid wastes, Feedlot wastes, Refeeding, Oxidation Ditch, Protein, Nutrients, Feed additive residues, Pathogenic bacteria, Performance.

Many systems can be projected for reclaiming nutrients from animal wastes. Direct refeeding of raw feedlot wastes above 25 to 30 percent of the rations may be detrimental to efficient animal performance. Liquid waste from an oxidation ditch system can be considered as a supplemental protein feed. The oxidation ditch is a biological processing step and aerobic degradations under favorable conditions may convert as much as 30 percent by weight of the decomposed waste into microbial cells (Hungate, 1972). However, a large fluid volume must be fed to achieve a supplemental level of protein. With either method of refeeding raw wastes, potential problems of pathogenic organisms, feed additive residues and nutrient accumulations need to be investigated. The aesthetic considerations could influence consumer acceptance of fed meat. But with the present emphasis and need for ecological balance, society may look with favor rather than distrust. Sound research and reasoned judgment should preclude the general use of animal wastes directly in the feed, even though it may be economically favorable to do so at this time. At the present time, total processing of large animal wastes appears to be the most satisfactory solution for utilizing animal waste nutrients. The projections in table 1 show that animals excrete 63.2 million pounds of nitrogen per day. If 10 percent of the nitrogen could be directly used in cattle feed, on an annual basis, it would have the equivalent protein value of 5 billion pounds of urea or 32 billion pounds of soybean meal. On another scale, the estimated annual manure production from beef and dairy cattle in need of removal in California is 2.5 million metric tons of dry matter (Clauson, 1971), or a potential yield of 500,000 metric tons of crude protein by the Whittingham or General Electric processes for nutrient reclamation. Any number and magnitude of projections can be made on the potential of animal wastes as a source of feed protein. If research and technology move forward with vigor and public support, there is no reason to doubt that animal wastes will be a great asset in the future production of meat protein. (Vetter-Iowa State University)

4604-B3, C2, E2

EFFECT OF LONG TERM MANURING ON THE SOIL PHOSPHATE POTENTIAL IN CALCAREOUS SOIL AND ITS RELATION TO P CONCENTRATION IN OAT PLANTS

Division of Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi, India
M. B. Sen Gupta
Journal of the Indian Society of Soil Science, V. 23, No. 4, p. 465-468, 1975. 2 tab., 7 ref.

Keywords: Farmyard wastes, Land application, Crop response, Phosphorus, Oats.

Phosphate potential (Schofield's) (SPP) showed little or no significance while equilibrium phosphate potential (EPP) showed high level of significance when correlated with P concentration in 60-days-old oat plants. Both SPP and EPP values showed low P intensity in the plots that received FYM or soil cake. Salt index of the fertilizers seems to be an important factor in controlling P intensity in soil. It was also revealed that the intensity of phosphate was associated with the initial rates of plant growth. (Copyright 1975-Journal of the Indian Society of Soil Science)

4605-B2, B4, D3, E2, E3, F1

AN ECONOMIC COMPARISON OF FIVE WASTE MANAGEMENT SYSTEMS FOR SWINE FINISHING OPERATIONS IN THE SOUTHEAST

Agricultural Engineering Department, Clemson University, Clemson, South Carolina
C. L. Barth, G. H. Aull, III, and D. T. Hill
Paper presented at Southeast Regional Meeting, American Society of Agricultural Engineers, New Orleans, Louisiana, Feb. 3, 1975, 17 p. 10 tab., 5 ref.

Keywords: Southeast U.S., Swine wastes, Liquid wastes, Waste management, Anaerobic lagoons, Irrigation, Deep pits, Oxidation ditch, Flushing, Waste storage, Land application, Costs, Economics.

This study made an economic comparison of 5 different waste management systems used with swine finishing operations in the Southeast. Systems evaluated were: (A) Manure flush to a single cell anaerobic lagoon with irrigation of excess supernatant and solids to cropland. (B) Deep pits under a partial slat floor (PSF) for 60-day storage period and application to cropland by liquid manure spreader. (C) Oxidation ditch under PSF with storage of excess solids and irrigation of excess ditch supernatant and solids to cropland. (D) Manure flush to 30-day storage pond and irrigation to cropland. (E) Shallow pit storage under PSF, anaerobic digestion of waste into methane production and utilization, collection of digester effluent in 30-day storage pond and irrigation to cropland. The swine finishing operation was assumed to be the same for all 5 systems. Results showed the use of an anaerobic lagoon for waste treatment was a break-even proposition economically. The oxidation ditch resulted in a net loss for the waste management system. Deep pit storage with honey wagon application to cropland was a system of intermediate profitability. The flush-irrigation system resulted in the greatest net annual benefit. Anaerobic digestion of swine waste was second in profitability and may become more lucrative if both the methane gas produced and the digestor effluent are effectively used in the farming operation. (Bates-East Central)

4606-A11, B1

NO NEED TO CONTROL MANURE EATING BY TURKEYS

Anonymous
Poultry Digest, V. 36, No. 429, p. 538, Nov., 1977.

Keywords: Turkeys, Manure eating, Animal health, Management.

It is suggested by Glyde Marsh, D.V.M., Ohio State University, that manure eating by turkeys should be ignored and that no attempts should be made to control or influence such eating. Turkeys that eat these brown, farmyard droppings do not experience disease problems or other difficulties. Flock treatment with antibiotics or copper sulfate stop the eating of manure, however, when the treatment is stopped the birds resume the habit. Change in rations may also cause turkeys to lose interest in eating manure. In most flocks as the birds age, the number of brown, foamy droppings passed is reduced and the habit is gradually lost. (Bates-East Central)

4607-B3, C1, D1, D3, E3, F1

FLY PROTEIN PRODUCTION FROM MECHANICALLY MIXED ANIMAL WASTES

Agricultural Environmental Quality Institute, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland 20705
N. O. Morgan and H. J. Eby
Israel Journal of Entomology, V. 10, p. 73-81, 1975. 1 fig., 1 tab., 3 ref.

Keywords: Recycling, Poultry wastes, Dairy cattle manure, Fly protein production, Mixing, Temperature, Moisture content, Refeeding, Soil conditioners, Economics.

Tests were conducted to devise a practical method of producing protein from large quantities of livestock wastes. A matched pair of portable concrete mixers was used for waste reduction and protein production. To facilitate separation of fly larvae from the reduced media, a mechanized larval recovery system was devised. In Test 1, the mixers were housed in the same temperature-controlled room as the hens, and feces were collected every3-4 days, weighed, and placed in one of the mixers. Mixing began on the third day and took place every 4 hours. From the fifth day on, maggots seen crawling about the chambers or on the surface of the media were considered mature and were transferred to the separation trays where the larvae wree collected, held through pupation, and weighed as pupae. For Test 2, the mixers were moved outdoors to a fly-proof screened cage, and feces from a commercial poultry farm were used. Due to wetness of the feces, sawdust (10 and 20 percent of the total weight of the mixture) was added in an attempt to improve living conditions for the maggots. Tests 3 and 4 were repetitions of Tests 1 and 2 except that dairy cow feces were used and temperature measurements were omitted. In Test 5, the ability of bioreduced cow feces to support subsequent generations of fly larvae was determined by reseeding 2 batches of bioreduced media. No additional sawdust or water were added. It was found that the fermenting medium, if allowed to stand unmixed for 3 or more days, generated so much heat that maggots were either driven from the container before they matured or died therein. Medium that was mixed frequently after seeding was usually warmer than room air temperature by the 3rd day, but it cooled by the 5th day, the day of larval migration. Wet medium became anaerobic within 3 days without mixing or aeration and was lethal to many of the house fly maggots. Addition of sawdust to poultry feces had little effect on production of fly protein. However, with cow manure, production was greatly increased by the sawdust. In Test 5, only a few larvae survived 10 days in 1 batch, and none in the other. The products from the waste reduction program included a protein used as part of a growing chick ration, a solid residue used as a soil conditioner, and water. In 1971, the fly-larva meal containing 63 percent protein was estimated to have a value of 209/ton. (Rowe-East Central)

4608-B2, C2, C3, D3

THE USE OF RESPIROMETRIC METHODS FOR ASSESSING THE BIODEGRADABILITY OF DIFFERENT COMPONENTS OF AGRICULTURAL WASTES

Department of Microbiology, West of Scotland Agricultural College, Auchincruive, Ayr, KA6, 5HW, Scotland
R. Hissett, M. R. Evans, and S. Baines
Progress in Water Technology, V. 7, No. 2, p. 13-21, 1975. 3 fig., 3 tab., 7 ref.

Keywords: Swine wastes, Poultry wastes, Biodegradability, Aerobic treatment, Chemical properties, Biological properties, Slurries, Fractionation, Respirometry.

Studies on coarse and fine solid particles, colloids, and solutes in fattening pig and laying hen excreta have shown that the ease and rapidity of their aerobic degradation are inversely proportional to particle size. The coarse solids were much more recalcitrant than organic matter in the other three fractions. Detailed information from this type of study should be useful for predicting the effectiveness of systems before they are built. It should also allow accurate comparison of different wastes in terms of their treatability. Differences in animal species and diets, housing systems, and methods of slurry handling could result in differences in the nature of the excreta produced. Also the position of a farm, the availability of land for spreading slurry or treated sludges, and variations in soil type will affect the degree of treatment required. Thus, there will never be one ideal system for all farms, but a variety of systems suited to differing situations. Detailed knowledge of the characteristics of excreta will be needed to enable to correct system to be chosen in each case. (Copyright 1975-Progress in Water Technology)

4609-A11, C2, D2, E3

WET CAGE LAYER MANURE FED TO FEEDLOT CATTLE

Anonymous
Feedstuffs, V. 49, No. 47, p. 14, Nov. 14, 1977. 1 tab.

Keywords: Wet cage layer manure, Preservatives, Refeeding, Cattle, Performance, Salmonellae.

Trials were run at the University of Guelph to: (1) compare the effectiveness of several mixtures of chemicals on the preservations of wet cage layer manure over a 28-day period and (2) determine the palatability, feeding value, and effects of animal health of acid-treated, wet cage layer manure fed to growing beef feedlot cattle. In the first experiment, the following preservatives were used: (1) 80 percent propionic acid + 20 percent acetic acid, (2) formaldehyde, (3) 30 percent formaldehyde + 70 percent propionic acid/acetic acid solution (80 percent:20 percent ratio). The 3 preservatives were applied at 3 rates – 0.25 percent, 0.5 percent, and 1 percent. The treated excreta and untreated controls were stored at 22°C for 28 days and checked at 7, 14, and 28 days. Each chemical preparation at 0.5 percent maintained excreta in an acceptable form in terms of physical appearance and nutritive value for 7 days. At 1 percent application preservation was adequate for 14 days. In the second experiment, 90 Hereford steers of 210 kg initial weight were randomly allotted to 3 corn silage-based diets supplemented with soybean meal, urea or cage layer manure. Laying hen manure was collected twice weekly, treated with 80 percent propionic acid, 20 percent acetic acid and stockpiled for daily mixing and feeding to steers over a 125-day trial. Steers grew equally well on soybean meal, urea and manure diets. The manure had no evident effect on carcass value. No salmonellae were isolated from the poultry manure samples, mixed feeds or cattle feces cultured during the trial. (Rowe - East Central)

4610-B2, B3, D3, E3

THERMONETICS -- THE GUYMON PROJECT

Anonymous
Calf News, V. 15, No. 11, p. 62, Nov., 1977.

Keywords: Recycling, Cattle wastes, Oklahoma, Methane, Fertilizers, Refeeding, Anaerobic digestion, Thermonetics, Calorific Recovery Anaerobic Process, Inc.

Thermonetics, an Oklahoma City-based company which specializes in energy conversion, is planning to open a sophisticated manure conversion plant at Hooker, Oklahoma by mid-November, 1977. The plant will convert cattle feedlot manure by anaerobic digestion into methane gas, a diluted liquid fertilizer and a cattle feedstuff called CALFEED. Using 500 tons of manure a day from three large feedlots nearby, the firm hopes to produce 1.6 million cubic feet of methane/day or 600 million cubic feed/year for use in Chicago, Illinois. These products will be produced under the name of Calorific Recovery Anaerobic Process, Inc. (Bates-East Central)

4611-B2, C1, C2, D3, E3, F1

METHANE GAS MADE FROM CONFINEMENT UNIT WASTE

J. D. Kendall
Feedstuffs, V. 49, No. 41, p. 12-13, Oct. 3, 1977.

Keywords: Swine wastes, Slurries, Waste treatment, Recycling, Southwest U.S., Anaerobic digester, Economics, Design, Recycling, Methane.

An experimental methane-gas producing swine unit using wastes from a confinement operation has been set up by University of Missouri researchers J. R. Fischer, N. F. Meador, D. M. Sievers, C. D. Fulhage and E. L. Iannotti. The objectives of the research were to (1) design, construct and operate and anaerobic digester engineered to the size of an average swine farm in the Midwest and (2) determine the management and economics of the system. The components that make up the confinement swine digester farm are the swine buildings and related manure handling systems; the settling basin for concentration of the manure slurry prior to loading the digester, and the digester. The digester itself is composed of the gas system, the heating system and electrical control system. Thec costs of the digester were about $22,000, excluding the engineering cost for design layout. (Bates-East Central)

4612-A4, B1, F2

PART III: STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION IN THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM: CONCENTRATED ANIMAL FEEDING OPERATIONS

Environmental Protection Agency
Federal Register, V. 41, No. 54, p. 11458-11461, March 18, 1976.

Keywords: Feedlots, Water pollution, Regulation, National Pollutant Discharge Elimination System, Environmental Protection Agency.

The proposed EPA regulations for the National Pollutant Discharge Elimination System concerning concentrated animal feeding operations are given along with definitions of animal feeding operations, concentrated animal feeding operations, and 'man-made'. The basic structure of the feedlot program is as follows: (A) Feedlots with 1000 or more animal units - permit required for all feedlots with discharges of pollutants. (B) Feedlots with less than 1000 but with 300 or more animal units - permit required if feedlot: (1) discharges pollutants through a manmade conveyance, or (2) discharges pollutants into waters passing through or coming into direct contact with animal in the confined area. Feedlots are subject to case-by-case designation requiring an individual permit only after on site inspection and notice to the owner or operator. (C) Feedlots with less than 300 animal units - no permit required (unless case-by-case designation. Case-by-case designation applies only if feedlot - (1) discharges pollutants through a manmade conveyance, or (2) discharges pollutants into waters passing through or coming into direct contact with animals in the confined area; and after on site inspection, written notice is transmitted to the owner or operator. A feedlot is not subject to requirement to obtain permit if discharge occurs only in the event of a 25 yr, 24 hr storm event. (Bates-East Central)

4613-B2, E2

AN INJECTOR-TANKER DESIGN TO APPLY LIQUID MANURE BETWEEN CORN CROP ROWS

Engineering Research Service, Agriculture Canada, Ottawa, Canada
M. Feldman and G. K. H. Thuns
Paper No. 76-214, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 14 p. 6 fig., 2 tab., 4 ref.

Keywords: Liquid wastes, Land application, Soil injection, Design, Corn.

A three-row liquid manure injector located on the frame in front of a 2,000 gallon vacuum liquid manure tanker was designed and built. The unit injects the slurry between every other corn row, so that each row receives liquid manure on one side only. In this way, injection into the tractor and tanker wheel paths, or travel of wheels in the path of already injected slurry was avoided. The unit works satisfactorily in 32- to 36-inch spaced corn rows, overcoming most of the disadvantages of other currently available injectors. Using an 85-90 hp tractor, the unit can inject 16-20 tons per acre of liquid manure, suitable for a field run length of approximately 1/4 mi. The unit will now be used for regular operations at the ARI farm to inject liquid manure between rows of growing corn. Future plans are still to incorporate a new injector shank design once this has been completed on another project. (Feldman-CSAE Member)

4614-B2, E2

A MODIFIED CENTRIFUGAL MANURE PUMP FOR HANDLING SEMI-SOLID CATTLE MANURE

Engineering Research Service, Agriculture Canada, Ottawa, Ontario
P. A. Phillips
Paper No. 76:212, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 6 p. 2 fig.

Keywords: Pumping, Equipment, Liquid wastes, Cattle manure, Waste storage, Land spreading.

A centrifugal force liquid manure pump (Badger 101) was mounted on a three-point hitch frame for the purpose of pumping semi-solid beef cattle manure directly from the flat slab of a manure storage into a manure spreader. The pump was found to work satisfactorily in manure ranging from 12 to 13 percent total solids where loading rates were about eight times faster than front-end loader. (Phillips-CSAE Member)

4615-B2, E2

ENGINEERING DESIGN OF LIQUID MANURE INJECTORS

Department of Agricultural Engineering, Macdonald Campus of McGill University, Ste. Anne de Bellevue, Quebec, Canada
S. Negi, E. McKyes, R. Godwin, G. Eades, and J. R. Ogilvie
Paper No. 76-211, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 17 p. 11 fig., 2 tab., 8 ref.

Keywords: Liquid wastes, Soil injectors, Equipment, Design, Model studies, Performance.

To improve the performance of liquid waste slurry subsurface injectors, a basic analysis is considered for the incorporation of slurry into the soil and the draft force requirements of the injectors. Means of calculation are provided for the volume of soil which must be disturbed to provide a stable soil cover for a volume of injected slurry, and the horizontal and vertical forces acting upon an injector shape of varying geometry in different soil types. An example injector is designed for a typical application and test results from a prototype model demonstrated. (Negi - McGill University)

4616-A7, B1, C1

EFFECTS OF POULTRY DUST ON PERFORMANCE OF A THERMOSIPHON HEAT RECOVERY SYSTEM

Gas Dynamics Laboratory, National Research Council, Montreal Road, Ottawa, Ontario, K1A 0R6, Canada
B. S. Larkin and J. E. Turnbull
Paper No. 76-209, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 12 p. 3 fig., 1 ref.

Keywords: Thermosiphon heat recovery system, Poultry dust, Air filtration, Equipment, Performance.

A previous paper reported the suitability of the thermosiphon-type heat exchanger for improving the winter heat balance in a caged layer chicken house. Continuation of the work with better instrumentation and different air filtration demonstrated that surface-loading washable air filters were more effective and easier to maintain than the deep-loading type. A maintenance routine consisting of vacuuming the filter inlet surface every 2 days, and washing the heat exchanger and filters every 30 days maintained satisfactory performance. A design is proposed to illustrate how the thermosiphon heat recovery system could be built into a modern commercial-sized caged chicken house. (Larkin - National Research Council)

4617-B2, B4, C1, C2, E2, F1

STUDIES ON A MIXING DISTRIBUTION SYSTEM FOR SWINE MANURE LAGOONS

Animal Waste Management Specialist, Engineering Field Services, Alberta Agriculture, Red Deer, Alberta, Canada
B. S. West
Paper No. 76-205, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 26 p. 4 fig., 3 tab., 4 ref.

Keywords: Swine wastes, Lagoons, Agitation, Sprinkler irrigation, Design, Slurries, Physical properties, Chemical properties, Nutrients, Equipment, Costs.

Removal of manure from open earthen lagoons has been a problem on many farms. A method of agitation using a large industrial mixer, mounted on a double trussed gantry spanning the lagoon was studied as a method of removing hog waste from a 24.4 m (80') X 30.5 m (100') lagoon. The sprinkler irrigation system used in conjunction with the mixer was also studied in the project. A properly designed mixer can successfully remove the liquid and solid manure from an open storage. This removal system, when combined with sprinkler irrigation, can provide a highly mechanical, low labor waste management system. Operational aspects, flow patterns, manure nutrient content and soil analysis for applied nutrients are discussed in the paper. A cost benefit analysis was calculated for the system, studied and compared to the more conventional hog waste systems used in Alberta. (West - Alberta Agriculture)

4618-A5, C1, C2, E2

INFLUENCES OF LAND SPREADING LIVESTOCK WASTES ON GROUNDWATER QUALITY

Bio-Resource Engineering Department, University of British Columbia, 2075 Wesbrook Mall, Vancouver, British Columbia, Canada V6T 1W5
L. M. Staley, T. H. Podmore, and B. Cappelaere
Paper No. 76-204, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 33 p.

13 fig., 9 tab., 3 ref.

Keywords: Groundwater quality, Livestock wastes, Land spreading, Swine wastes, Dairy wastes.

Groundwater quality has been monitored over three winter seasons for two pasture sites in the Lower Fraser Valley, an undrained upland glacial outwash material receiving swine manure and a tile-drained lowland organic soil receiving dairy manure. Phosphates at both sites remained very low. The nitrogen load appeared significant, mostly in the form of nitrates at the drained site (up to 7.2 ppm), but in the form of ammonia and organic-N at the undrained plot (up to 30 ppm total-N), probably resulting from aerobic and anaerobic conditions respectively. However, water quality in wells surrounding the latter site proved to be high in nitrates (up to 10 ppm) but low in total-N (under 1 ppm). (Staley - University of British Columbia)

4619-B3, D1, E3, F1
ENGINEERING EVALUATION OF A POULTRY MANURE DEHYDRATING MACHINE

Agricultural Research Engineer, NSAC, Truro
D. A. Browning, J. D. Gunn, and C. G. E. Downing
Paper No. 76-207, Canadian Society of Agricultural Engineering, 1976 Annual Meeting, Halifax, Nova Scotia, July 4-8, 1976, 18 p. 3 fig., 3 tab.

Keywords: Dehydration, Poultry manure, Equipment, MAWO Manure Dryer, Fuel Costs, Economics, Recycling, Soil Amendments.

The evaluation of the MAWO manure dryer provided a valuable insight into this method of waste management in Atlantic Canada. An alternate method of conveying raw product into the machine would increase its versatility in handling a wider variety of materials: For the dehydrating of cage layer poultry manure with no in-house drying, the machine worked well. High fuel costs may be the major drawback to the use of such a system if environmental aspects are not a primary consideration. (Browning-CSAE Member)

4620-A2, B2, B4, C1, C2, E2
FEEDLOT RUNOFF CONTROL SYSTEMS FOR COLD CLIMATES

Agricultural Engineering Department, North Dakota State University, Fargo, North Dakota
G. L. Pratt, R. W. Schottman, D. A. Swenson, and M. L. Buchanan
Paper No. 75-203, Canadian Society of Agricultural Engineers, 1975 Annual Meeting, Brandon University, June 22-26, 1975, 25 p. 9 fig., 5 tab., 8 ref.

Keywords: Agricultural runoff, Runoff control, Irrigation, Design, North Dakota, Physical properties, Chemical properties, Waste storage, Cold climates.

A common method of control of runoff from feedlots is to intercept the runoff and divert it to a storage pond. It is held in the pond until weather conditions are satisfactory for disposal of the water by irrigation on cropland. Design requirements for the systems for intercepting, storing, and disposing of the water have been established for regions where irrigation equipment can be operated through most of the year. It is common in North Dakota to have the temperature drop below freezing in November or December and remain below that level until March. This condition results in a build-up of snow, ice, and manure that remains until the spring thaw. When the thaw occurs, the snow and ice generally melt in a short time. The research reported in this paper was designed to determine how the quantity of runoff from the winter accumulation of ice and snow in North Dakota compares with runoff from the 24-hour storm data now being used. (Pratt-North Dakota State University)

4621-B2, C2, D1, D2
A METHOD FOR THE QUANTITATIVE EXTRACTION OF ADENOSINETRIPHOSPHATE (ATP) FROM COW SLURRY

Department of Microbiology, The University of Reading, London Road, Reading, RG1 5AQ, England
A. H. Varnum and J. M. Grainger
Journal of Applied Bacteriology, V. 36, p. 9-10, 1973. 8 ref.

Keywords: Cattle wastes, Slurries, Extraction, Adenosinetriphosphate, Homogenization, Centrifuging, Chemical treatment.

In an investigation of the effects of the application of heavy dressings of cow slurry to farm land, a suitable procedure for extracting adenosinetriphosphate from cow slurry was developed. The main features of the procedure adopted for routine use were homogenization of slurry suspension in morpholinopropane sulphonic acid-KOH buffer, extraction of adenosinetriphosphate by dimethylsulphoxide at pH 7.6, dilution in morpholinopropane sulphonic acid-KOH buffer, centrifuging and assay of supernatant fluid for adenosine-triphosphate by a Du Pont 760 Luminescence Biometer. The method proved satisfactory for fresh, stored and decomposing cow slurry. It was also suitable for use with soil. (Merryman-East Central)

4622-A11, B2, C3, E2
THE SURVIVAL OF *ESCHERICHIA COLI and SALMONELLA DUBLIN* IN SLURRY ON PASTURE AND THE INFECTIVITY OF *S. DUBLIN* FOR GRAZING CALVES

Agricultural Research Council, Institute for Research on Animal Diseases, Compton, Nr. Newbury, Berks, England
R. J. Taylor and M. R. Burrows
British Veterinary Journal, V. 127, p. 536-543, 1971. 3 tab., 3 ref.

Keywords: Pathogenic bacteria, Cattle wastes, Slurries, Land disposal, Survival time, Animal health, Palatability.

Investigations were performed to obtain information on the length of time that *Escherichia coli* and *Salmonella dublin* were likely to survive on pasture, whether cattle accept slurry-polluted pasture and to what extent contaminated pasture is a health hazard to grazing animals. Under the conditions of the test, *Escherichia coli* survived 7-8 days. *Salmonella dublin* survived 18 days on the lower levels of grass and up to 12 weeks in the soil. When the grass was cropped, however, no recoveries were made after 7 days. For 2 days after calves were allowed to graze a pasture receiving heavy amounts of slurry, the calves rejected the polluted area. However, by seven days, the calves had grazed it well. Calves became infected after grazing pasture to which 10^6 *Salmonella dublin*/ml of slurry had been applied on the previous day. However, no cases occurred when the contamination rate was reduced to 10^3 ml. (Merryman-East Central)

4623-B2, C2, D3, E3
A HOMESITE POWER UNIT: METHANE GENERATOR

Alternative Energy Systems, 242 Copse Road, Madison, Connecticut 06443
L. M. Auerbach
A Homesite Power Unit: Methane Generator, 1973, 50 p. 3 fig., 6 tab., 21 ref.

Keywords: Anaerobic digester, Slurries, Waste treatment, Organic wastes, Recycling, Methane, Design, Gas storage.

A homesite power unit model is presented in this publication. This home power unit is a system that processes human, pet and livestock manures, other animal products and vegetable matter into an easy-to-handle compost, while also producing a gas useful as a fuel or heat source. The basic component of the system is an anaerobic digester which can be constructed from a tank. Design, construction, and operational guidelines are given. (Merryman-East Central)

4624-A8, E2, F1
EFFECT OF CROP ROTATION, FARM YARD MANURE AND THE QUANTITY OF SALINE IRRIGATION WATER ON THE YIELD OF WHEAT AND PHYSICO-CHEMICAL PROPERTIES OF THE SOIL

S.K.N. College of Agriculture, University of Udaipur, JOBNER-Campus, India
T. C. Jain, G. S. Saxena, K. C. Jain, and K. L. Totawat
Indian Journal of Agricultural Research, V. 10, No. 1, p. 1-9, March, 1976. 9 tab., 7 ref.

Keywords: Wheat yields, Soil properties, Land application, Farm yard manure, Irrigation, Crop rotation, Salinity, Economics.

A field experiment was conducted to determine the effects of crop rotations, farm yard manure applications, and irrigation levels on the yield of wheat and on the physico-chemical soil properties. The experiment period was 1969-70 to 1971-72. Though the irrigation water had an EC of 4.8 mmhos/cm, no appreciable accumulations of salts occurred in 0-60 cm depth because the soils were highly permeable. Leaving the land fallow in *kharif* resulted in slight compactness of lower layers of the soil. When a *kharif* crop preceded a wheat crop, bulk density of the soil was reduced and hydraulic conductivity was considerably improved. Wheat yield was not improved by application of excess water (25 percent over field capacity) or by the use of farm yard manure in place of urea as basal dose (40 kg N/ha). While crop rotation had no significant results, it was found that net returns of the guar-wheat rotation was best economically in this study area. (Merryman-East Central)

4625-A10, B3, C3, D3

SMALL DUNG BEETLES AS BIOLOGICAL CONTROL AGENTS: LABORATORY STUDIES OF BEETLE ACTION ON TRICHOSTRONGYLID EGGS IN SHEEP AND CATTLE FECES

Division of Microbiology and Veterinary Medicine, University of Wyoming, Laramie, Wyoming 82070
R. C. Bergstrom, L. R. Maki and B. A. Werner
Proceedings of the Helminthological Society of Washington, V. 43, No. 2, p. 171-174, 1976. 2 tab., 8 ref.

Keywords: Sheep wastes, Trichostrongylid eggs, Beetles, Temperature.

A study was conducted to determine whether or not small beetles such as the *Aphodius* spp. and *Canthon practicola* might affect trichostrongylid egg numbers in feces of sheep and cattle. In the trials, bovine fecal material was collected by means of diapers on lambs which had been orally infected via drench with third-stage larvae of *Trichostrongylus colubriformis*. Feces taken from the diapers were placed in plastic sacks and weighed. Eleven trials were conducted at laboratory temperatures of ± 20 C. Four beetle species of the genus *Aphodius* and *Canthon practicola* were used in trials with mixed species of trichostrongylid eggs. For 22-49 hours, the beetles were allowed to act on the feces and trichostrongylid eggs. Ten to 20 beetles were allowed to feed 1-5 days on 5-100 g of feces containing 12-3,000 trichostrongylid eggs per g. Numbers of trichostrongylid eggs decreased 24-90 percent in cultures with beetles than in those without beetles within 5 days. (Rowe-East Central)

4626-A5, C2

A SUMMARY OF THE BIOGEOCHEMISTRY OF NITROGEN COMPOUNDS IN GROUND WATER

California State University, Chico, California
J. Behnke
Journal of Hydrology, V. 27, No. 1/2, p. 155-167, Oct., 1975. 4 fig., 55 ref.

Keywords: Groundwater pollution, Nitrates, Nitrogen compounds, Pollutant sources, Leaching.

This article attempts to briefly summarize the history of nitrogen compounds in the bioshell and to relate nitrates to the biogeochemistry of other nitrogen compounds involved in the nitrogen cycle. The article summarizes groundwater nitrate occurrences and provides the reader with an updated bibliography concerning such occurrences. Most reported cases of excessive nitrate build-ups in shallow groundwaters seem to be related to the downward leaching of nitrogen by surface water. Such leaching requires a relatively open geologic profile between the ground surface and the water table. Reported sources for groundwater nitrate contamination include decaying plant and animal material, organic sediments, agricultural fertilizers, domestic sewage, and areas of high density animal confinement. (Bates-East Central)

4627-A5, B1, C2, E2

NITRATE POLLUTION OF GROUNDWATER FROM NITROGEN FERTILIZERS AND ANIMAL WASTES IN THE PUNJAB, INDIA

Department of Soils, Punjab Agricultural University, Ludhiana, India
B. Singh and G. S. Sekhon
Agriculture and Environment, V. 3, No. 1, p. 57-67, Dec., 1976. 4 fig., 2 tab., 15 ref.

Keywords: Groundwater pollution, Nitrates, India, Fertilizers, Animal wastes, Sampling, Electrical conductivity.

An investigation was made of the effect of N-fertilization on nitrate concentration in soil and groundwater under cultivated areas of the Ludhiana district where N-application rates are the highest in the Punjab (India). Water samples were collected from 57 wells and analyzed for nitrates. Nitrate content of well water near villages was significantly higher than in the cultivated areas. The major contributor to high nitrate levels in the groundwater under villages appeared to be animal wastes. Although farmyard manure is added along with chemical fertilizers in the cultivated areas, crop plants absorb most of the applied nutrients from both of these sources, leaving only a small amount which can be leached beyond the potential rooting zone. However, while nitrate content was markedly higher in groundwater near villages, the mean electrical conductivity of the groundwater was only slightly higher than under cultivation. Both arithmetic and geometric means increased slightly in the villages just after the monsoon season, but no significant increase was observed in the cultivated areas. These observations indicated that groundwater in the study area was recharged during the rainy season and that salts were leached to the water table. These data indirectly confirm the role of animal wastes in increasing the nitrate concentration of well water near villages. It is felt that in cultivated areas, nitrate concentration of of well water is not now in equilibrium with present day agriculture. If that is so, a mean (geometric) nitrate concentration as high as 35 ppm in groundwater can be expected in future years. These hypotheses can only be confirmed by further investigations. (Rowe-East Central)

4628-A8, B2, C1, C2, E2

SPREADING SLURRY ON LAND

Department of Agriculture for Northern Ireland and the Queen's University of Belfast
J. S. V. McAllister
Soil Science, V. 123, No. 5, p. 338-343, 1977. 4 tab., 29 ref.

Keywords: Slurries, Livestock wastes, Land application, Nutrients, Drainage, Anaerobic conditions, Nitrogen, Volatile fatty acids, Phosphorus, Potassium.

Slurry, a mixture of animal feces, urine, and varying quantities of extraneous water, can be a valuable source of plant nutrients. However, if large quantities of such slurry are spread on limited areas of land, problems may occur. A buildup of nutrients in the upper layers of the soil can result in nutrient imbalances or adverse effects on soil structure and aeration. Anaerobic soil conditions may occur, resulting in production of volatile fatty acids by microbial decomposition. Such volatile fatty acids can inhibit plant growth. Because pollution and adverse growing conditions can result from improper slurry applications, slurry dressings should be applied only when soil and climatic conditions are suitable. (Rowe-East Central)

4629-A11, A12, B2, B3, B4, C3, E2

PERSISTENCE OF THREE SALMONELLA SPP. IN BOVINE FAECES

Bacteriology Division, School of Agriculture, Aberdeen, Scotland
D. C. Jeffrey
The Veterinary Record, V. 88, p. 329, March 27, 1971. 7 ref.

Keywords: Salmonella spp., Cattle wastes, Liquid wastes, Solid wastes, Waste storage, Survival rate, Land application, Manure heap.

An investigation was conducted to determine the survival time of *Salmonella bredeney*, *Salmonella livingstone*, and *Salmonella elmsbutettel* in a bovine feces and urine mixture sprayed onto pastures as slurry, and in bovine feces and urine mixed with bedding straw. Slurry from contaminated cattle was collected beneath slatted floor courts and was kept in the courts for the five-month summer period before it was sprayed onto pastures, while the organic manure was taken from the courts at the beginning of summer and compounded into a manure heap in the corner of a grass field. Eight months later the manure heap was spread over cereal stubble and plowed into the soil. After a period of 220 days, 60 samples of grass and soil were taken throughout the fields on which slurry had been spread, along with 25 samples from within the manure heap. While all the Salmonella organisms were isolated from all the initial slurry samples and from more than half the organic manure samples, none of the 3 species in question were found in any of the samples taken after periods of 220 or 300 days. (Merryman-East Central)

4630-A8, B3, C2, E2

EFFECT OF GYPSUM, FARMYARD MANURE AND ZINC ON THE YIELD OF BERSEEM, RICE AND MAIZE GROWN IN A HIGHLY SODIC SOIL

Central Soil Salinity Research Institute, Karnal 132 001, India
K. S. Dargan, B. L. Gaul, I. P. Abrol, and D. R. Bhumbla
Indian Journal of Agricultural Science, V. 46, No. 11, p. 535-541, Nov., 1976. 6 tab., 7 ref.

Keywords: Land application, Sodic soils, Gypsum, Farmyard manure, Zinc, Crop response, Berseem, Rice, Maize, Soil properties.

A study was made of the effect of gypsum and farmyard manure, applied alone and in combination, on crop growth in a highly sodic soil. The effects of zinc application were also studied. The field trials were conducted at the Central Soil Salinity Research Institute, Karnal, India. The trials were started in the winter of 1970-71 and continued until the summer of 1973. Treatment applications and replications are described. The overall conclusion was that the surface 15 cm of the soil were improved adequately to obtain good yields of rice and berseem, but not for maize. (Merryman-East Central)

4631-A11, B2, C1, C2, E3

LIQUID DIETS CONTAINING POULTRY WASTES FOR RUMINANTS

Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada
M. McNiven, J. D. Summers, and S. Leeson
Canadian Journal of Animal Science, V. 56, No. 2, p. 221-226, June, 1976. 5 tab., 16 ref.

Keywords: Diets, Sheep, Liquid wastes, Poultry wastes, Refeeding, Performance, Dry matter, Nitrogen.

Mature sheep were fed a control corn-soybean meal diet, the same diet mixed with water to give a dry matter:water content ratio of 1:4, or a corn-wet, caged layer manure (CLM) diet containing 80 percent moisture. Digestible dry matter, nitrogen and energy were highest for the liquid control diet. The CLM diet gave results comparable to that of the dry control diet. Feeding the same diets to growing lamb confirmed the superiority of the liquid control diet as compared to the same ration fed in the dry form. Weight gain and feed:gain ratio were superior for the CLM diet as compared to the dry control. (Copyright 1976 - Canadian Journal of Animal Science)

4632-A6, B2, B4, C2

SIMPLE PHENOLS AND INDOLES IN ANAEROBICALLY STORED PIGGERY WASTES

Laboratory of Microbiology, Agricultural University, Wageningen, The Netherlands
S. F. Spoelstra
Journal of the Science of Food and Agriculture, V. 28, No. 5, p. 415-423, May, 1977. 4 fig., 3 tab., 16 ref.

Keywords: Swine wastes, Waste storage, Anaerobic conditions, Chemical properties, Odor, Hydrolysis, Glucuronides, Protein degradation.

Phenol, p-cresol, indole, skatole, and 4-ethylpherol, which contribute to the bad smell of piggeries, were found to be constituents of anaerobically stored pig slurry. Indole, skatole, and p-cresole were also found in freshly voided feces. The fast initial increase of phenols upon the addition of urine to feces, the inhibitory effect of glucaro-1, 4-lactone, and the high B-glucuronidase activity in feces indicated that the increased concentrations of phenols were at least partially due to the hydrolysis of corresponding urinary glucuronides by feces B-glururonidase. It was felt that the initial increase of p-cresol was largely explained and that the increase of 4-ethylphenol was completely explained by hydrolysis of their urinary glucuronides. The experiments also indicated that phenols and indoles were also derived from protein degradation. (Merryman-East Central)

4633-B2, B4, C2, D1, D3, E4

CHANGES IN THE SHORT-CHAIN CARBOXYLIC ACID CONTENT AND CHEMICAL OXYGEN DEMAND OF STORED PIG SLURRY

Department of Agricultural and Food Chemistry, Queen's University, Newforge Lane, Belfast BT9 5PX
A. E. J. McGill and N. Jackson
Journal of the Science of Food and Agriculture, V. 28, No. 5, p. 424-430, May, 1977. 4 fig., 3 tab., 9 ref.

Keywords: Swine wastes, Slurries, By-product recovery, Fungus, Carboxylic acids, Substrates, Sample size, Temperature, Waste storage, Agitation, Filtration.

Because it is known that the presence of short-chain carboxylic acids in substrates enhances the growth rates of fungus, experiments were performed to determine the effects of sample size, temperature, and duration of storage on the concentrations of short-chain carboxylic acids and the chemical oxygen demand (COD) of pig slurry. It was found that the relative proportions of the short-chain carboxylic acids remained fairly constant irrespective of total concentration. Samples stored under laboratory conditions contained higher concentrations of short-chain carboxylic acids than any of the other stored samples, although the initial concentrations were of the same order. COD concentrations followed the same trends as the acid analyses. Following agitation, COD values of the samples remained fairly constant with greater oxygen depletion in the larger sub-samples. Filtration of slurry sub-sample supernatants produced marked decreases in COD and acid content of the filtrate. Oxygen loss and the production of maximum acid concentrations increased at higher temperatures. The fungus *L. lacteus* won't grow in the absence of oxygen. Consequently, fairly constant aeration of pig slurry would be required to maintain its growth on that substrate. The presence of short-chain carboxylic acids, particularly acetic acid, has been shown to improve the growth rate of the fungus, and the concentrations of acids found in the slurry are of sufficient magnitude to be significant. However, the concentrations of suitable nitrogenous compounds have been shown to be the limiting factor for the growth of this fungus on a pig slurry substrate. (Merryman-East Central)

4634-C2, D3

ANALYSIS OF THE ROTTING PROCESS OF SAWDUST BARNYARD MANURE

Faculty of Agriculture, Nagoya University, Nagoya, Japan
M. Suzuki and K. Kumada
Soil Science and Plant Nutrition, V. 22, No. 4, p. 361-372, 1976. 7 fig., 6 tab., 10 ref.

Keywords: Barnyard manure, Sawdust, Composting, Rotting, Stratification, Humification, pH, Electrical conductivity, Fermentation, Physical properties, Chemical properties.

The decomposition of sawdust barnyard manure was investigated in order to evaluate the rotting process of plant remains with a high C/N ratio which is highly resistant to decomposition. Sawdust barnyard manure was produced at the farm of the Faculty Agriculture, Nagoya University by spreading sawdust in a loose-barn type cowshed where cows were allowed to leave their wastes freely. The manure was collected after 2 months, when the ratio of sawdust and animal waste was approximately 1:1. The manure was placed outdoors in a 1.5 m-high pile and allowed to ferment for a short period. The pile was mixed once more and left undisturbed for one year. The resulting compost had a stratified vertical profile of 6 layers which seemed to reflect the varying degrees of humification. The layers were described as follows: (1) The outermost layer was light brown. (2) Underneath the outermost layer was a thick, light brown layer containing a large amount of fungal hyphae, a low moisture content, and a water-repelling nature, (3) Under that layer was a thin, dark brown layer which appeared to be well aerated and moist, (4) The innermost layer was greenish-brown, anaerobic, and smelled of ammonia, (5) Located between layers 1 and 2 near the foot of the pile was a dark brown layer, (6) Another layer was found in a hollow on the top. Samples were taken from each layer and one of the dark brown layers was fractionated physically. The following results were obtained: (1) All samples collected from the compost pile had lower pH and electrical conductivity (EC) values and C/N ratios than fresh barnyard manure. (2) The humus composition of air-dried samples showed differences with regard to the amount of extracted humus, percent of extracted humus, and RF value. (3) Six size fractions were obtained by physical fractionation of the dark-colored layer. The finer size fractions had higher amounts of extracted humus, humic acid, fulvic acid, and total N. C/N ratio in finer size fractions was lower. Total nitrogen content and C/N ratio were negatively correlated with the amount of extracted humus. The water-soluble fraction had properties notably different from the other fractions. (Merryman-East Central)

4635-A11, C2, D2, D3, E3

BIOCHEMICAL AND NUTRITIONAL STUDIES ON FERMENTED-AMMONIATED ANIMAL FEED SUPPLEMENTS

J. D. Moore
Ph.D. Dissertation, Auburn University, Aug. 25, 1972, 82 p. 2 fig., 16 tab., 122 ref.

Keywords: Refeeding, Feedlot cattle manure, Fermentation, Ammonification, Sheep, Performance, Amino acids, Organic acids, Lactic acids, Palatability, Toxicity, Nitrogen retention rates.

An experiment was conducted to determine whether the protein value of cattle manure could be easily and economically increased by some biological means. Feedlot cattle manure was alternately fermented anaerobically and treated with anhydrous ammonia until fermentation ceased. Amino acid content of the manure was increased 11.57 percent and apparent crude protein equivalent was increased 16.35 to 42.18 percent. Organic acid composition was changed 4.47 to 25.95 percent. Lactic acid content of the treated manure was 16.35 gms in every 100 gms of dry matter. Acceptability of fresh manure fed to lambs was not affected by treatments. In a 10-day palatability trial, lambs fed fresh cattle feedlot manure mixed with a basal ration consumed 0.072 kg of feed dry matter per kg metabolic body size per day. Lambs fed fermented-ammoniated manure mixed in the same proportions with the basal ration consumed 0.072 kg. In a toxicity trial, sheep were given either ammonium acetate, ammonium lactate, or urea at the nitrogen equivalent rate of 0.88 gm urea per kg body weight. Ammonium acetate caused the death of 2 ewes within 2 hours. Ammonium lactate caused the death of one ewe between 2 and 3 hours post-dosing. Urea caused the death of one ewe between 2 and 3 hours post-dosing and a delayed urea toxicity reaction and elevated blood ammonia levels in another ewe. In a feeding trial, lambs were given various nitrogenous supplements in a corn based ration. Daily gains for lambs fed isonitrogenous diets containing cottonseed meal, ammonium lactate, urea, corn, fresh manure, fermented-ammoniated corn and fermented ammoniated manure were 226, 222, 221, 215, 176, and 143 gms, respectively. During a nitrogen balance trial, lambs were fed cottonseed meal, fermented-ammoniated whey, ammonium lactate, fermented-ammoniated manure and urea in semi-purified, isonitrogenous, isocaloric diets. Nitrogen retention rates were 0.08, 0.58, 0.47, 0.28, and 0.07 gms per kg metabolic body size per day. Blood plasma amino acid data were collected on these lambs, but no significant relationships were obtained. (Merryman-East Central)

4636-B2, C2, D3

A COMPARISON OF pH-CONTROLLED AND DISSOLVED OXYGEN-CONTROLLED NUTRIENT ADDITION FOR THE MAINTENANCE OF STEADY-STATE IN A MIXED CONTINUOUS CULTURE

Bacteriology Division, School of Agriculture, 581 King Street, Aberdeen, Scotland
K. Robinson and D. Fenlon
Journal of Applied Bacteriology, V. 42, p. 393-403, 1977. 2 fig., 5 tab., 7 ref.

Keywords: Swine wastes, Biological treatment, Performance, pH, Dissolved oxygen saturation.

The purpose of this work was to compare the performance of the mixed microbial flora of 2 laboratory fermenter systems using the supernatant liquor from an anaerobic lagoon of pig wastes, and to assess the prospects of maintaining steady-state cultures where substrate addition was determined by response of changes from selected values of pH (7.0) or dissolved oxygen saturation (70 percent). Other parameters measured were: Soluble and suspended solids (DS and SS); total and soluble chemical oxygen demand (COD$_T$ and COD); suspended solids COD (COD$_{SS}$); NH$_4^+$-N of the influent and mixed liquor; NO$_3^-$-N and NO$_2^-$-N of the mixed liquor; influent volume. Control of pH produced a lower COD$_D$ than with DO control and permitted a greater volume of substrate to be processed. COD$_{SS}$ increased during stabilization. NH$_4^+$-N concentrations were similar for both fermenters but concentrations of oxidized nitrogen varied. Nitrification/denitrification sequences appeared to be initiated by unscheduled changes in DO concentrations. It was possible to maintain a steady state with respect to a controlled parameter and end-product quality but other parameters varied due to the non-uniformity of biochemical activity by a mixed culture. (Bates - East Central)

4637-B2, C2, D1, D2, D3, E4

ALGAL GROWTH IN DILUTED PIG WASTE

Oregon State University, Corvallis, Oregon
E. W. R. Barlow, L. Boersma, H. K. Phinney, and J. R. Miner
Agriculture and Environment, V. 2, No. 4, p. 339-355, 1975. 11 fig., 21 ref.

Keywords: Swine wastes, By-product recovery, Algae, Methane, Energy, Recycling, Filtration, Centrifugation.

The goal of this study was to develop a management system to utilize micro-organisms for the conversion of animal waste into a high-protein feed. Other considerations were: the development of a system which does not require a massive energy input, utilization of the methane gas produced as an energy source for the system, able to be used ''on site'', and no release of pollutants into the environment. Based on the results of preliminary experiments conducted in the laboratory, a photo-autograph algae *Chlorella vulgaris* 211/8K proved to be the most suitable organism and was used in all further experiments. *Chlorella vulgaris* 211/8K grew much better in fresh manure suspensions than in suspensions clarified by filtration through activated charcoal or by precipitation with FeCl$_3$. High aeration rates and an incubation temperature of 37°C favored high ammonia volatilization (61 percent-54 percent). The growth rate of the algae was dependent on the NH-N concentration of the manure (ie. growth rate decreased at nitrogen concentrations of less than 250 kg/1). Nitrogen recovered by the algae ranged from 34.4 percent for 6.7 days retention time to 17.5 percent for 2.5 days of retention. The essential amino acids content of *Chlorella vulgaris* 211/8K compared favorably with milk and soy protein. In preliminary feeding trials using rats, the algal protein appeared better than cottonseed as a feed source. Two different harvesting methods were used, centrifugation and flocculation with A12 (SO$_4$)$_3$-with filtration of flocculant. The aluminum levels in the alum flocculated algae were toxic to rats. The stability of the cultures was considered the most encouraging aspect of the laboratory studies. The average production rate at 37°C for a 12 hour photoperiod with retention time of 3.3 days was about 22g/m /day. Field experiments will be initiated as the next step in the development of the waste management system. (Bates-East Central)

4638-B2, E2

EARTHWORM POPULATION OF A PASTURE SPRAY-IRRIGATED WITH DAIRY SHED EFFLUENT

Soil Bureau, DSIR, P. B., Lower Hutt, New Zealand
G. W. Yeates
New Zealand Journal of Agricultural Research, V. 19, No. 3, p. 387-391, 1976. 1 fig., 3 tab., 6 ref.

Keywords: Dairy wastes, Liquid wastes, Spray irrigation, Earthworm population.

A study was conducted to estimate the effects of effluent disposal on earthworm population. A 3-year spray irrigation trial was started where 30,000 1/day of effluent from 300-350 cows was sprayed over a 1.6 ha pasture. Total earthworm population averaged 10.1 (5.25-18.10) million/ha weighing 2082 (1590-7110) kg. The annual dry matter production was of the order of 15,000-20,000 kg/ha. From six determinations, the mean dry matter content of bulk earthworm collections was found to be 15 percent, the mean C content was 38.6 percent, and N content was 8.2 percent. Conclusions drawn from the study were: (1) Difference in population levels between effluent disposal and control area was due, in part, to differing rates of dry matter production; (2) Maintenance of a relatively high soil moisture level in the effluent disposal area from September to November, coupled with increasing soil temperatures, resulted in a high population in November, and the relatively moist soil in December to March, compared with the control area, reduced relative earthworm mortality; (3) Sampling indicated that effluent disposal stimulated the earthworm population, ensuring adequate incorporation of the applied organic material into the soil and maintenance of a high infiltration rate. (Rowe-East Central)

4639-A11, B3, C2, E3

USING DEHYDRATED POULTRY WASTE IN POULTRY RATIONS -- A REVIEW

Dairy and Poultry Science Department, Kansas State University, Manhattan, Kansas 66506
F. E. Cunningham
Agriculture and Environment, V. 3, No. 3, p. 69-76, Dec., 1976. 1 tab., 49 ref.

Keywords: Dehydrated poultry wastes, Refeeding, Chemical properties, Broilers, Layers, Performance, Carcass quality.

Factors involved in using dehydrated poultry waste as a feed ingredient in poultry rations are reviewed. After poultry excreta is processed, the product is an entirely new feed ingredient. One name for it is dehydrated poultry waste (DPW). The composition of DPW varies. DPW is a substantial source of crude protein. It is also high in ash, calcium, and phosphorus. However, DPW as a feed for poultry has a relatively low energy value. Some studies have indicated that DPW, when fed to broilers, resulted in depressed growth rate and feed efficiency. However, the DPW had no noticeable effect on broiler carcass quality. Researchers have concluded that DPW may be used as nearly 20 percent of a broiler's feed. Other studies have indicated that DPW can be used in layer rations in amounts up to 15 percent without important changes in production, feed efficiency, or egg size. Further research on the use of DPW is needed. (Rowe-East Central)

4640-A7, A11, B2, C3, D3, E3

LEPTOSPIRES IN ANIMAL WASTE TREATMENT -- ANIMAL HEALTH PROBLEM?

Department of Veterinary Microbiology and Public Health, College of Veterinary Medicine, University of Minnesota, St. Paul, Minnesota.
L. A. Will and S. L. Diesch
Proceedings of the 76th Annual Meeting, United States Animal Health Association, 1972, p. 138-149. 4 fig., 4 tab., 8 ref.

Keywords: Animal wastes, Leptospires, Animal health, Hamsters, Aerosols, Refeeding, Cattle waste, Oxidation ditch slurry.

The objectives of these studies were to measure and identify the viability and infectivity of *L. pomona* MLS in aerosols, recycled feed (RCF), and manure slurry of extended aeration beef manure treatment in a model oxidation ditch (M.O.D.). An environmental control chamber was constructed in order to monitor the responses of test animals (hamsters) exposed to contaminated food, water, and air. The M.O.D. studies were conducted at two environmental temperatures: winter - 2°C and summer - 20 C. *Leptospira* serotype *pomona* MLS was isolated from the manure slurry throughout the ditch experiments. Leptospires were not isolated from aerosol samples collected from the control chamber. The hamsters fed recycled contaminated feed or exposed to the ambient air of the M.O.D. failed to show either serological or cultural evidence of infection. (Bates - East Central)

4641-A11, A12, B1, C2, E3

RECYCLING AND DEGRADATION OF ANABOLIC AGENTS IN ANIMAL EXCRETA

Biological Waste Management Laboratory, Agricultural Environmental Quality Institute, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland 20705
C. C. Calvert and L. W. Smith
Environmental Quality and Safety, Supplement Volume V, Anabolic Agents in Animal Production, FAO/WHO Symposium, Rome, March, 1975, Georg Thieme Publishers, Stuttgart, Germany, 1976, p. 203-211. 6 tab., 46 ref.

Keywords: Refeeding, Livestock wastes, Poultry wastes, Fertilizers, Anabolic agents, Hormones, Estrogens, Androgens, Diethylstilbestrol, Animal health, Public health.

This report deals with the kinds of exogenous hormones approved for use as anabolic agents in U.S. livestock and poultry production and the endogenous hormones excreted by various species of livestock and poultry. The levels of residues detected in excreta from both hormone sources, the degradation of residues in processed excreta and the effects of these residues in excreta recycled in feed and fertilizer on animal health and their occurence in consumer products are discussed. The exogenous hormones approved for use as cattle feed additives are diethylstilbestrol (DES) and melengesterol acetate (MGA). There are seven hormones approved for injection in cattle and one for poultry. They are: Estradiol monopalmitate (poultry), DES (steers and heifers), DES and Testosterone (steers and heifers), Estradiol benzoate and Testosterone (heifers), Estradiol benzoate and Progesterone (steers and lambs), Zeranol (steers, heifers and lambs). Two endogenous compounds excreted by animals that are of concern in recycling excreta in animal feed are estrogens and androgens. It was found DES either by injection or feeding would be the major concern in recycling animal excreta as feed. However, there is insufficient data at present to state that DES is or is not harmful. Experiments, so far, have shown no adverse effects from feeding excreta that could be attributed to DES or other hormone preparations. Research to date reports no beneficial or adverse animal responses that can be attributed to endogenous hormones in animal excreta used in feeds. (Bates-East Central)

4642-A8, A11, B1, C2, C3, E2, E3

INTERRELATIONSHIPS BETWEEN ANIMALS AND ENVIRONMENT IN HIGH-INTENSITY LIVESTOCK PRODUCTION

Institute of Animal Production, Federal Institute of Technology, Zurich, Switzerland
F. L. Hays and W. Blanca
Agriculture and Environment, V. 2, p. 311-331, 1975. 2 fig., 71 ref.

Keywords: Confinement pens, Feedlots, Livestock wastes, Pollution, Animal health, Metabolic wastes, Land application, Refeeding.

Various ways in which animals and environment influence each other under conditions of high-intensity production are presented. In high-intensity production, large amounts of animal waste products are generated which pollute the environment and are harmful to animal health and production. Three cycles were determined for the animal/environment relationship. These were: (1) A primary cycle which covers metabolic waste products, particularly heat, water vapor, carbon dioxide, methane, feces, and urine, as well as the effects of these agents on the animals. These effects include: sweating, panting, hyperthermia, eye irritation, and respiratory tract irritation. (2) A secondary cycle comprised of those metabolic waste products which have been broken down and transformed from feces and urine, such as hydrogen sulfide and ammonia. These gases may cause inflammations of mucous membrances, pulmonary oedema, dyspnea, gastro-intestinal disturbances, hemorrhages and eventually depression of growth rate and milk yield. (3) A third cycle which covers the agents that have been eliminated from the indoor environment to the outdoor environment. These include chemicals from liquid manure and pathogenic micro-organisms. These agents enter the groundwater, the soil, and the plants. They may return to the animals with the feed and drinking water with toxic effects. A reduction of such adverse effects of animal wastes products may be attempted by the following means: (1) by keeping an optimal balance between livestock and crop management, (2) by choosing optimal sizes of animal production units in relation to their mutual distances, and (3) by refeeding suitably treated manure to animals. (Merryman-East Central)

4643-A11, B3, C3, D3, E3

ENSILED POULTRY LITTER REDUCES CATTLE FEED COSTS

Anonymous
Poultry Digest, V. 36, No. 429, p. 538, Nov., 1977.

Keywords: Poultry litter, Ensiling, Refeeding, Cattle, Palatability, Pathogenic bacteria.

Research done at Clemson University showed that ensiled poultry litter can be fed to cattle. Using mini silos, appropriate moisture levels (35 to 40 percent) and length of time required to ensile poultry litter (6 weeks) were determined. Ensiled poultry litter was fed to dairy heifers, beef steers and mature beef cows. In all cases, feeding ensiled litter resulted in a reduction in feed costs. The most profitable use of litter is in wintering feed for mature brood cows. Up to 87 percent more litter may be in the diets of these cows. Ensiling litter helps to render the litter more palatable for cattle and destroys potential disease-causing organisms. (Bates-East Central)

4644-B2, B3, D1, E2

PONDER THIS SWITCH-BACK, FIELD SINK SYSTEM

Anonymous
Dairy, V. 34, No. 1, p. 20-21, Nov., 1977. 1 fig.

Keywords: Dairy wastes, Runoff, Switch-back waterway, Field sink, Settling, Drying, Land spreading.

A dairy waste system was installed on the farm of dairyman John Ronhovde, Lincoln, Nebraska. It featured a switch-back waterway built in conjunction with a holding pond below the paved lot to handle runoff. The switch-back system, a winding waterway 650 feet long with a flat grade and a bottom width of 15 feet, had a terrace covered with grass to provide enough ground surface area so that runoff was slowed and a lot of it absorbed by the soil before it reached the end of the waterway. The system also featured a "field sink" to hold excess runoff. Debris traps made of hail screen located in the switch-back inlet collected the solids carried in liquid runoff from the concrete lot. After the solid wastes settle and dry, the solids are scooped from the 130-foot by 20-foot rectangular debris basin, loaded into a conventional manure spreader and later are spread on cropland. The 800 gallons of daily waste water collected from the milking parlor flows into the 120-day holding pond. Depending upon the topography of their farms, Ronhovde feels the system may prove feasible for other dairymen. (Rowe-East Central)

4645-A3, A4, A12

WATER POLLUTION FROM NON-POINT SOURCES

Midwest Research Institute, Kansas City, Missouri 64110
A. D. McElroy, S. Y. Chiu, J. S. Nebgen, A. Aleti and A. E. Vandegrift
Water Research, V. 9, No. 7, p. 675-681, July, 1975. 3 tab., 18 ref.

Keywords: Water pollution, Nonpoint sources, Public health, Agriculture, Silviculture, Runoff, Mining, Construction, Return flow, Erosion, Sediment, Acid mine drainage, Salinity, Heavy metals, Nutrients, Pesticides, Thermal discharges, Radioactivity, Microbial pollution.

The aim of this study was to assess the nature and extent of non-point source pollution in the United States from 4 major industrial activities: agriculture, silviculture, mining and construction. In agriculture, the major pollutants are sediment, nutrients, pesticides, organic wastes and microbial pollution. Pollutants from silvicultural operations include sediment, nutrients, pesticides and thermal discharges. Erosion sediment, acid mine drainage, salinity and heavy metals are major pollutants from mining. Sediment is the primary pollutant from the construction industry. (Bates-East Central)

4646-A11, B2, B5, E2

A FURTHER ASSESSMENT OF THE POTENTIAL HAZARD FOR CALVES ALLOWED TO GRAZE PASTURE CONTAMINATED WITH *SALMONELLA DUBLIN* IN SLURRY

A. R. C. Institute for Research on Animal Diseases, Compton, Newbury, Berks., England
R. J. Taylor
British Veterinary Journal, V. 129, p. 354-359, 1973. 2 tab., 3 ref.

Keywords: Slurries, Land application, Salmonella dublin, Grazing, Animal health, Calves.

Experimental conditions were produced to simulate modern farming practices and to indicate the severity of the risk to which grazing calves are exposed. The infectivity for calves of pasture contaminated with *Salmonella dublin* in slurry was studied. The pasture was about 0.3 ha (0.8 acres) of mature pasture. Four out of six calves in each of two experiments became infected when slurry contained 10^6 *S. dublin* per ml but none became infected when allowed to graze pasture which had been contaminated with

10^9 *S. dublin* per ml. Under the conditions of the experiment, it was concluded that the risk to the health of grazing calves was not great. (Rowe-East Central)

4647-B2, D3, E3
GROWTH OF ALGAE ON PIG MANURE

Department of Microbiology, University College, Galway, Ireland
M. Wilson and J. A. Houghton
Irish Journal of Agricultural Research, V. 13, p. 49-60, 1974. 1 fig., 8 tab., 7 ref.

Keywords: Swine wastes, Lagoons, Algae, Waste disposal, Waste digestion, By-product recovery, Ireland.

The growth of algae on pig manure and the decomposition of the waste was studied. Investigated was the algal flora of two pig waste lagoons. Results of the algal screening program indicated that of the 21 species studied, only 4 species isolated from the lagoon samples would grow on 15 and 20 percent pig manure and no algae could tolerate a 25 percent concentration of manure. The permanganate value (PV) of the manure was measured before and after the growth of the algae. Good algal growth and a mean detention time of only 1.58 days was achieved by a light intensity of 16,150 lx. The decrease in light intensity produced by increasing depth led to a decrease in algal growth. With increasing temperature, the growth rate and PV reduction increased. In samples inoculated with *C. pyrenoidosa* the reduction of PV was considerably greater than in algae-free cultures. This shows the value of an algal/bacterial system as a means of waste digestion. (Rowe-East Central)

4648-B5, C2, D1, D3
THE AGRONOMIC ROLE OF INTRODUCED DUNG BEETLES IN GRAZING SYSTEMS

Division of Plant Industry, CSIRO, Canberra, A.C.T., Australia
G. T. McKinney and F. H. W. Morley
Journal of Applied Ecology, V. 12, No. 3, p. 831-837, 1975. 2 fig., 19 ref.

Keywords: Pastures, Manure deposits, Rainfall, Temperature, Manure burial, Crop response, Nitrogen, Dung beetles, Grazing.

The effect of dung deposition on heavily stocked pastures where fecal deposition was a problem was studied. The amount of dung deposited depends on the number of animals, and the amount and digestibility of the food they eat, which depends on rainfall and temperature. The rejection of herbage by grazing animals seems unlikely to influence animal production to any significant extent. The burial of dung may reduce losses of N from feces and permit the use of this N by plants for a year or two. The area affected is unlikely to exceed 15 percent of the total. On pastures to which N is regularly applied, the amount by which production is increased over that of adjacent areas is likely to be slight. For pastures based on legumes the increase may be about 15-20 percent, but the value may be partly offset by a reduction of the legume content of the pasture. The probable gain (8-15 percent of the area x 15-20 percent extra growth) may be only 1-3 percent of extra production. The benefits of introducing dung beetles to improve the N status of pasture seems doubtful, since it will most likely occur in spring when the slowly available N is being mineralized. (Rowe-East Central)

4649-B3, B4, C2, C3, D1, D3, E3
CONSERVATION OF CATTLE MANURE IN PITS

Agricultural Research Corporation, Wad Medani
M. M. Musa and H. Fawzi
Sudan Agricultural Journal, V. 7, p. 27-34, 1972. 6 tab., 9 ref.

Keywords: Cattle wastes, Pit storage, Chemical properties, Nitrogen, Fertilizers.

A study was undertaken at Nishashiba Livestock Improvement Centre in order to evaluate cattle manure stored in pits, using the chemical composition of the manure, its microbiological activity, and pot and field tests as criteria for its nitrogen supplying ability. The study resulted in the following conclusions: (1) The manure was initially low in nitrogen due to the absence of an absorbent straw material and the high temperature. This resulted in large losses of ammonia before filling the pits. (2) Shallow pits dried more than deeper ones. (3) An appreciable proportion of the soluble nitrogen fraction was initially in the form of ammonia and this tended to accumulate to higher values in deeper pits. (4) There was nitrate buildup after 4 months of storage, especially in some shallow pits. (5) More nitrogen uptake from manure-treated pots was found in the 2 pot experiments than the control soil. However, the fresh manure was slightly superior after one month but much less so after four months of storage. (6) Under field conditions, the stored product in deep pits was nearly equal to fresh dung in manurial value. (7) The mesophilic aerobic microbial population decreased with storage time. The carbon dioxide evolution from stored manures indicated that it could serve as a suitable parameter for their maturity if dried overnight prior to incubation. (8) The method presented seems to conserve the nitrogen of the manure in a form suitable for plant utilization. Also, sanitation hazards are greatly reduced. (Merryman - East Central)

4650-A8, B2, B3, B5, C2, E2
ANIMAL MANURES IN GRASS PRODUCTION

Plant Nutrition/Chemistry Department, Johnstown Castle Research Centre, Wexford, Ireland
H. Tunney
Seminar for Agricultural Advisors, Spring, 1975, 8 p. 2 fig., 7 tab.

Keywords: Swine wastes, Poultry wastes, Cattle wastes, Slurries, Land application, Soil tests, Chemical analysis, Nutrients, Potassium, Phosphorus, Nitrogen, Application rates.

While animal manures are a valuable source of plant nutrients for grassland, certain precautions must be taken. The soil should be analyzed occasionally to avoid excess or deficiency of nutrients on the land receiving the manures. Manures should be spread as evenly as possible and slurries should be agitated before spreading. When possible, cattle manures should be recycled to land conserved for hay or silage. Cattle slurry is not well suited for pasture application because it is too high in potassium (or low in phosphorus) and, in addition, may reduce the palatability of the grass. Application of 1000 gals/acre supplemented with 1 bag of 8 percent P will supply enough P and K for one year's grazing. Cattle slurry should be applied at least 4-5 weeks before grazing to reduce its effect on palatability and risk of spreading disease. Pig slurry is a balanced source of P and K for pasture. Pig slurry at 1500 gals/acre or poultry slurry at 700 gals/acre will supply adequate phosphorus and potassium for one year's grazing and enough nitrogen for one grazing. (Merryman-East Central)

4651-A11, B2, B4, B5, C2, E2, F1
FERTILISER VALUE OF ANIMAL MANURES

The Agricultural Institute, Johnstown Castle Research Centre, Wexford, Ireland
H. Tunney
Utilization of Manures by Land Spreading, E.E.C. sponsored seminar, Modena, Italy, Sept., 1976, p. 7-19. 4 fig., 4 tab., 9 ref.

Keywords: Swine wastes, Cattle wastes, Waste storage, Land application, Slurries, Grassland, Silage, Animal health, Nutrients, Nitrogen, Phosphorus, Potassium, Ireland, Economics.

In Ireland, there are 3 main types of manure storage: (1) Farmyard manure - where straw is used as bedding material, (2) Dungstead manure - where the manure without bedding is scraped into a compound about 1.5 m deep, liquids are allowed to drain off and drying takes place during the summer. This manure is usually spread on grassland in the autumn. The liquid from this type of storage is usually irrigated by a small electrically operated pump, (3) Slurry - consists of feces and urine mixed with variable quantities of rain and wash water. Most pig manure and a small but increasing proportion of cattle manure is stored and spread as slurry. For maximum benefit from pig slurry nutrients, the slurry should be applied at rates to supply adequate phosphorus and nitrogen and supplemented with potassium fertilizer. Cattle slurry should be applied at rates to supply adequate potassium and should be supplemented with phosphorus and nitrogen. Under Irish conditions, it is recommended that cattle slurry be applied to land conserved for silage or hay. Cattle slurry is not suitable for grazing land because it has too much potassium. A dressing as low as $10m^3$/ha would mean excess potassium was being used. Also, there may be risk to animal health where slurry is applied for grazing. Pig slurry, however, is particularly well suited for pasture. $17m^3$/ha of good pig slurry will supply the annual phosphorus and potassium requirements. Pig slurry is also ideal for hay and silage land. The slurry should be applied to grassland that has been closely grazed or cut. Applying slurry to long grass increases the risk of contamination and can reduce yield. Slurry for silage should be applied 7-6 weeks before cutting. In Ireland, the most suitable time for application is April for first cut silage and in June for a second cut. Because the cost of storing and spreading manure is considerable, maximizing the fertilizer value of the manure will help recover part of the cost. (Merryman-East Central)

4652-A8, E2
SUCCESSIONS OF MICRO-ORGANISMS AND INVERTEBRATA AND THEIR CONNECTIONS WITH BIOCHEMICAL PROCESSES DURING DECOMPOSITION OF MANURE IN SOIL

Kasaner Institut fur Biologie der Akademie der Wissenschaften der UdSSR und Kasaner Universitat
M. M. Alejnikova, T. I. Artem'jeva, T. M. Borisovic, F. G. Gatilova, S. M. Samosova, N. M. Utrobina, and L. I. Sitova
Pedobiologia, V. 15, No. 2, p. 81-97, 1975.

Keywords: Land application, Manure, Decomposition, Soil microbiology, Decomposition, Soil microbiology, Decomposition, Naphthalene.

Decomposition experiments with manure in a cultivated meadow-chernozem were made in 1967. Eighty capron-mesh-bags with (300 g) manure were buried 10 cm deep in the soil; 40 bags with manure only, 40 bags with manure mixed with naphthalene (300:9). Naphthalene reduced the populations of microarthropods and changed the microflora qualitatively. Significant retardation of rotting processes, caused by naphthalene showed the importance of soil invertebrates in the breakdown of organic substances in the soil. Some rotting-phases of manure were characterized by occurrence and activity of distinct and interrelated populations of microorganisms and soil invertebrates. The succession of soil invertebrate communities during rotting processes was demonstrated by the changing dominance of Collembola, Oribatei and Pyemotidae. (Alejnikova-Kasaner Institut fur Biologie) (Article in German)

4653-A8
AN EXPERIMENT ON DUNG REMOVAL BY *APHODIUS* LARVAE (SCARABAEIDAE) AND EARTHWORMS

Institute of General Zoology, University of Copenhagen, Denmark
P. Holter
Oikos, V. 28, No. 1, p. 130-136, 1977. 1 fig., 4 tab., 21 ref.

Keywords: *Aphodius* larvae, Earthworms, Dung removal, Organic matter.

Cattle dung pats from the field, initially without *Aphodius* larvae, were transferred to tubs with clean sand or garden soil. The experiment included four treatments: (1) pats on sand (controls); (2) pats on sand, 95 A. *rufipes* L. larvae added per pat; (3) pats on soil, 35-40 earthworms (mostly *Lumbricus terrestris* L.) added per pat; (4) pats on soil, 85 *Aphodius* larvae and 35-40 worms added per pat. The open tube were placed outdoors for six weeks. The controls lost about 16 percent of their organic matter (averaged over the duration of the experiment). In treatment (2) loss of organic matter attributable to larvae was 0.62 g per larvae, i.e. 6-7 times the larval assimilation. Burial of organic matter contributed about 40 percent of this loss. In treatment (3) 0.75 g organic matter per g earthworm were lost through earthworm activity, under certain assumptions. The decrease in organic matter of pats subjected to treatment (4) indicated a simple additive effect of larvae and earthworms, without interactions. (Copyright 1977-Oikos)

4654-B2, C2, D3, E2, E3
ANAEROBIC DIGESTION OF AGRICULTURAL WASTES

Rowett Research Institute, Bucksburn, Aberdeen, Scotland AB2 9SB
P. N. Hobson
Rowett Research Institute Reprint No. 916, 1976, p. 109-122. 2 tab., 15 ref.

Keywords: Anaerobic digestion, Swine wastes, Cattle wastes, Poultry wastes, Biological treatment, Slurries, Waste storage, Land disposal, Energy, Recycling.

This review describes work on "mechanical" anaerobic treatment being carried out at Rowett Research Institute in collaboration with the North of Scotland College of Agriculture. The first experiments were done in 15-litre stirred digesters heated to 35°C. Because use of whole pig slurries precluded mechanical loading, the digesters were hand-loaded once a day while anaerobic conditions were maintained. These small digesters were run in steady states over some years and showed that a significant reduction in pollutants and potential pollutants in the waste could be obtained and the digesters could be run at a lower detention time than domestic digesters, although some fall-off in performance was apparent at a 14-day detention time. When the experiments were continued with a 100-litre digester which could be mechanically loaded at 5 minute intervals, the reduction in pollution was better than with the small digesters and the detention time could be decreased to 10, or even 7 days without significantly affecting performance. Recently, pilot-plant (150-litre) investigation of cattle and poultry digestion was started. A new type of pump on the digesters enabled wastes of higher solids content to be handled. Digestions of poultry and cattle wastes were started from an inoculum of digesting pig waste. So far, operation of the digesters at only a few detention times and solids concentrations have been tested, but it seems as if the optimum detention times for these wastes will be longer than that for the piggery waste. Anaerobic digestion, like any other treatment system, is not suggested as the answer to every farm waste disposal problem. However, it would seem that anaerobic digestion can appreciably reduce the polluting power of such wastes and so make them more acceptable for storage, land dumping, or spreading as fertilizer. Also, even if a digester produces no more than enough gas for its own heating, the energy costs of pollution control are comparable with those of any other system. (Merryman-East Central)

4655-B2, C1, C2, D3, E3
NOTES ON ANAEROBIC DIGESTION AND ANAEROBIC DIGESTERS BASED ON EXPERIMENTAL PLANT IN ABERDEEN

Microbiology Department, Rowett Research Institute, Bucksburn, Aberdeen, Scotland
P. N. Hobson, R. Summers, S. Bousfield, P. J. Mills, D. Clouston, and I. Auld
Notes on Anaerobic Digestion and Anaerobic Digesters Based on Experimental Plant in Aberdeen, July, 1977, 39 p. 7 tab.

Keywords: Anaerobic digestion, Design, Swine wastes, Cattle wastes, Poultry wastes, Mixing, Temperature, Fermentation, Slurries, Detention times, Gas production, Methane, Carbon dioxide, Fuels, Recycling, Fertilizers, Sludge.

These notes provide background for designing and running anaerobic digesters and the results to be expected from the digestion of wastes. While comments and results are universally applicable, a digester system must be designed for the site. Farm conditions must be considered not only in calculating plant size and results of digestion of the particular waste but also in the practical details of construction. Also, such factors as climate and labor availability must be considered. Results quoted in these notes are based on the oepration of 3 pilot-plant digesters of about 150 liters capacity and 2 small farm scale digesters of about 13,000 liters capacity. Information is given concerning: (1) digester design, (2) starting up digesters, (3) running digesters, and (4) the results of anaerobic digestion. Such factors as detention times, reduction of pollution and gas production are discussed in terms of piggery wastes, cattle wastes and poultry wastes. Appendices consider: (1) some notes on mixing, (2) temperature of digestion, (3) sizes of digesters, and (4) a comparison of digestion and aeration treatment of the same waste. (Merryman-East Central)

4656-B2, B3, B4, C1, C2, D3, E1
THREE-STEP TREATMENT FOR PIGGERY WASTES

Laboratory of General and Industrial Microbiology, The University of Gent, 9000 Gent, Belgium
H. Vanstaen, J. P. Voets, and W. Verstraete
Water Research, V. 10, No. 10, p. 927-928, 1976. 1 fig., 2 tab., 5 ref.

Keywords: Swine wastes, Aerobic treatment, Anaerobic treatment, Effluent quality, Biochemical oxygen demand, Nitrification, Activated sludge, Physical properties, Chemical properties.

This paper reports the results of a pilot study in which an alternative three-step method for the treatment of piggery wastes was investigated. In this three-step treatment, the first aerobic treatment transforms the soluble BOD to microbial biomass and causes partial nitrification. The second step acts as a septic tank. A large amount of the biomass is retained and considerable amounts of oxidized nitrogenous compounds are removed. The third tank provides conventional activated sludge treatment. During the experiments the manure from a sow house, in which the manure was diluted because of an unlimited drinking water supply, and a fattening pig house, in which the drinking water supply was limited for a few hours a day, was used. Two experiments were conducted, one using the diluted wastewater and the other using the more concentration wastewater. In the first experiment using the diluted wastewater, about 70 percent of the treated volume of wastewater could be discarded as effluent while 30 percent had to be stored as surplus sludge. In the second experiment, the total amount of surplus sludge to be stored amounted to 50 percent of the initial volume. In both experiments, the effluents were of acceptable BOD, appearance and odor. The content of non-degradable organic matter, N and P made them unacceptable for discharge into oligotrophic waters, although the liquid effluent could be discharged into a farm holding pond. (Bates-East Central)

4657-A11, B2, C3, E2
THE SURVIVAL OF *SALMONELLA DUBLIN* IN CATTLE SLURRY

Ministry of Agriculture, Fisheries and Food, Veterinary Investigation Centre, Whitley Road, Longbenton, Newcastle upon Tyne, England NE12 9SE
C. R. Findley
Veterinary Record, V. 89, p. 224-225, Aug. 21, 1971. 3 ref.

Keywords: Slurries, Dairy cattle, Bacteria, *Salmonella Dublin*, Land spreading, Disease.

The interim findings on the survival of *Salmonella dublin* in cattle slurry are reported by C. R. Findley, Ministry of Agriculture, Fisheries and Food. In this experiment, the slurry was collected from a 150-cow dairy herd housed in cubicles and it contained dairy washings and yard washings; it was collected in mid-October when the cows were mostly at grass and could be termed "summer" slurry. The dry-matter content was 8.7 percent and the pH was 7.25. Three tanks, each containing 9 gallons of slurry, were seeded with a smooth culture of *S. dublin* so that the final concentrations was 10 x 10 organisms/c.c. One tank was left covered (Bin 2), the second was left open (Bin 3), and the third was spread on a 9 sq. yd. plot. *S. dublin* was recovered regularly from both tanks for 5 mos. after inoculation. Every week 2 swabs from each bin were placed in liquid medium – one in selenite F broth (Sel F), the other in brilliant green broth (BGB). After incubation at 37°C for 24 hr., each broth was subcultured onto desoxycholate citrate agar (DCA). Out of a possible 25 recoveries, the results were as follows: Bin 2- Sel F/DCA – 8, BGB/DCA – 23, Bin 3 - Sel F/DCA – 3, BGB/DCA – 24. Grass from the plots was cultured in BGB/DCA and no organisms were found 2 weeks after spreading. Guinea-pigs fed on the grass seven weeks after spreading did not become infected. However, the organism was isolated from soil cores 5 months after spreading and it was still felt that the persistence of *S. dublin* in slurry and in the soil in which slurry had been placed might prove to be a disease risk to animals grazing the pasture. (Bates - East Central)

4658-B2, C2, D3, E3

PRACTICAL ASPECTS OF ANAEROBIC DIGESTION

Rowett Research Institute, Aberdeen, Scotland
R. Summers and S. Bousfield
Rowett Research Institute Reprint No. 876, 4 p. 1 fig., 2 tab., 18 ref.

Keywords: Farm wastes, Domestic wastes, Factory wastes, Anaerobic digesters, Gases, Recycling, England, Fertilizers.

Practical applications of the anaerobic digestion of various forms of waste are discussed with special emphasis on farm wastes. First consideration was given to the treatment of domestic wastes in anaerobic digestion plants at sewage works. The London Sewage System anaerobically digests about 650 tons of sewage sludge per day from a population of some seven and a half million people, and produces an average of nine million cubic feet of gas daily. Some of this gas is compressed and sold and the rest is used to run dual-fuel engines or gas turbines which provide 80-90 percent of the power needed to run the sewage works. In contrast to domestic wastes, which are relatively similar, factory wastes differ widely, depending on the processes which have been carried out. Some wastes are unsuitable for anaerobic digestion because they contain substances inhibitory to bacterial activity. Factory wastes that are readily digestible include slaughterhouse, fruit and vegetable, alcohol fermentation, and pulp and paper wastes. Because of their strength, however, such wastes often have to be pretreated on-site before discharge. The amount of animal wastes produced by farm animals is greater per capita than from humans. Anaerobic digesters for farm wastes can be divided into 2 types. First, there is the small, warm-climate plant treating the wastes from just a few animals – the Gober gas unit. Second, there are larger, heated digesters of temperate climates digesting the waste from several hundred or more animals. The smaller digesters use no mechanization or additional heating and are very inefficient. The larger digesters must be automated and heated to work efficiently. Animal wastes are produced within small areas, are amenable to digestion, and the gas production per unit volume is high. Many uses can be found for surplus gas on-site, the pollutional power of the waste is considerably reduced and, in many cases, the digested sludge could be used as a fertilizer. (Merryman-East Central)

4659-A4, A6, B2, C1, C2, C3, D3, E2

AEROBIC TREATMENT IN RELATION TO LAND APPLICATION OF SLURRY

The West of Scotland Agricultural College, Auchincruive, Ayr, Scotland
S. Baines
Utilization of Manure by Land Spreading. Commission of the European Communities, EUR 5672e, 1977, p. 413-432. 5 fig., 3 tab., 11 ref.

Keywords: Aerobic treatment, Design, Odor, Water pollution, Biodegradation, Sludge residence time, Dissolved oxygen concentration, Temperature, Pathogenic bacteria.

Data from laboratory experiments at The West of Scotland Agricultural College provide useful criteria for the design and operation of aerobic treatment plants to be used in systems where air and water pollution present problems. In the presence of an adequate supply of dissolved oxygen, a mixed population of microorganisms will become established and convert the chemical components of slurry from one form into another, and into microbial cells. Ultimately, aerobic metabolism will result in the production of carbon dioxide, water, inorganic salts, heat energy, and microbial cells. The variety and activity of microorganisms that become established and hence, the degree of biodegradation, depends on a variety of physical and chemical parameters including mean residence time of microorganisms or sludge residence time (SRT), dissolved oxygen concentration, and temperature. These factors are also important in the capital and operating costs of treatment systems. Because variation in operational parameters will affect the end products, the process can be manipulated to meet one or more of the desired objectives of treatment. Primary solids/liquid separation by physical and mechanical techniques must also be considered in conjunction with biological treatment to gain an appreciation of the economic and handling aspects. (Merryman-East Central)

4660-A8, B3, C2, E2

SUPPRESSION OF SUPERPHOSPHATE-PHOSPHORUS FIXATION BY FARMYARD MANURE: I. HIGH PHOSPHORUS UPTAKE FROM SUPERPHOSPHATE

Nuclear Institute for Agriculture and Biology, Lyallpur, Pakistan
M. Sharif, F. M. Chaudhry and A. Latif
Soil Science and Plant Nutrition, V. 20, No. 4, p. 387-393, Dec., 1974. 3 tab., 19 ref.

Keywords: Land application, Fertilizers, Farmyard manure, Superphosphate-phosphorus, Crop response, Maize, Cotton, Wheat, Pakistan.

A pot experiment was performed to study the effect of premixing at various ratios of 32P labelled SUP (Superphosphate) and FYM (farmyard manure) on the uptake of fertilizer phosphorus by maize plants. The results were tested in fields of cotton and wheat. These experiments were performed on alkaline calcareous soils. The studies indicated that premixing SUP with FYM appreciably increased availability of fertilizer-phosphorus to plants from alkaline calcareous soils of Pakistan. Premixing increased the availability of SUP-P (superphosphate-phosphorus) much more from lower doses of SUP than from higher doses. Premixing also increased the availability of SUP-P to plants at their later stages of growth rather than at their earlier stages. Since plants suffer from phosphorus deficiency mainly during the later stages of growth, the mixing technique would be highly useful in phosphorus nutrition of plants. (Merryman-East Central)

4661-A8, B1, E3

DEVELOPMENT OF A SYNTHETIC COMPOST FOR MUSHROOM GROWING BASED ON WHEAT STRAW AND CHICKEN MANURE

Mushroom Experimental Station, Horst (L), the Netherlands
J.P.G. Gerrits
Netherlands Journal of Agricultural Science, V. 22, No. 3, p. 175-194, 1974. 7 fig., 12 tab., 27 ref.

Keywords: Composting, Poultry manure, Straw, Gypsum, Chopping, Nitrogen, Mushrooms.

This paper explains how a high-yielding synthetic compost can be prepared primarily from straw and chicken manure. Most experiments were carried out with various amounts of chicken manure and urea. Some attention was paid to time of supplementation, watering, inoculation with dried bacteria, and nitrogen sources (ie. calcium ammonium nitrate and calcium cyanamide). Addition of town waste compost and spent mushroom compost and the effect of chopping the straw before composting starts were also studied. A practical formula for the preparation of synthetic compost is presented, and some of the important factors in composting are elucidated. The formula is as follows: 1000 kg of chopped wheat straw is watered with 4000 liters of water. The straw is then mixed with 1000 kg of chicken manure and the material is turned according to the scheme 0, 4, 7, 11, 12. For every kg of gypsum are added and on day 12, the compost is ready and can be filled. This mixture produces 3300 kg of compost. At filling, this compost has a C/N ratio of 18, a nitrogen content of 2.0 percent and an ammonia content of 0.4 percent, and a pH of 8.6. If less chicken manure is used, it is possible to apply nitrogen as urea or ammonium nitrate, urine, or vinasse, but if the amount of chicken manure becomes too small, yield is negatively affected. The watering procedure is not very important so long as the moisture content is fairly constant during composting; however, moisture content at filling and spawning will determine the yield. Use of spent mushroom compost is not recommended because this decreases yield. No positive effect of adding dried bacteria, which should stimulate heating, could be established. (Bates-East Central)

4662-A1, A4, B1, C2, D3, E3
THE WASTE PRODUCTS OF AGRICULTURE

Head of Department of Agricultural Engineering, University of Newcastle upon Tyne, Newcastle upon Tyne, NEL 7RU, England
J. R. O'Callaghan
Journal of the Royal Society of Arts, V. 123, No. 5223, p. 139-149, Feb., 1975. 2 tab.

Keywords: Agricultural wastes, Livestock wastes, Straw, Waste management, Recycling, Methane, Fertilizers, Foods, Fuels, Bedding, Strawboard, Paper pulp.

Dealing with agricultural wastes can be a problem. For dealing with the waste problems of any processing activity, there are 4 general methods of approach: (1) Reduce waste at source by improving the efficiency of the process which is the waste source. (2) Use the waste from one process as the raw material for another process. (3) Dump the waste and run the risk of pollution; a course which is no longer possible and is in any case hazardous. (4) Process the waste in order that it may be dumped. The two main waste products resulting from agricultural production which are disposed of in such a way as to be a source of pollution are the manures from livestock units and straw from cereal enterprises. Animal manures could be utilized as a source of methane through utilization of the anaerobic fermentation process. Also the residual products of the fermenter would have fertilizer value and the organic polluting capacity of the wastes would be reduced. Animal manures could also be looked upon as a source of nutrients. Factors which currently seriously impede recovery of nutrients in animal manure are: (1) An attitude towards disposal rather than utilization. (2) Inadequate farm manure storage means manure produced during the winter months has to be spread on the fields, thus increasing water pollution and uselessly expending nutrients outside the growing season. More effective use of animal manures is necessary both as a means of reducing pollution of water sources and of conserving energy and raw materials through replacement of inorganic sources of fertilizer. Proper storage, mixing and timing of the applications to crops are a necessity, however. As for straw, about 9 million tons of straw are produced every harvest in England. Slightly more than one-third of it is used for animal bedding and a similar amount is burned. Some of the remainder is used as a feed for ruminants, some is ploughed in and a small amount is used industrially for products such as strawboard. From the farmer's point of view, producing straw for pulp for making paper is as yet uneconomical. In parallel with any studies by the producers on the use of straw as a raw material for pulp, there should be a very great effort on the industrial side to find cheaper methods of processing. (Merryman-East Central)

4663-B1
DECISION TOOLS FOR DAIRY MANURE HANDLING SYSTEMS' SELECTION

Department of Agricultural Engineering, Cornell University, Ithaca, New York
L. M. Safley, Jr., D. A. Haith, and D. R. Price
Paper No. 77-4028, American Society of Agricultural Engineers, 1977 Annual Meeting, North Carolina State University, June 27-29, 1977, 22 p. 12 tab., 25 ref.

Keywords: Linear programming models, Dairy industry, Waste management, Decision making, Economics.

Two linear programming models were presented to help dairy farmers decide which type of manure system was best suited for their operation, and how much could be spent on a manure handling system. Factors to be considered in evaluating a manure system include: labor, energy usage, herd size, land availability, and fertilizer value of the manure. Factors to be considered in determining the necessary costs of a system include: economic data, cropping rotations, manure management and nutrient cycles. Both models relied on simple, straight-forward constraints, but they were found to provide the management answers necessary for making sound decisions. (Rowe-East Central)

4664-A1, A6, A7, A10, A11, B1, D1, D3, E3, F1
NEW RECYCLING TRIAL SHOWS $20/HD EXTRA PROFIT

Anonymous
Calf News, V. 15, No. 11, p. 50-52, Nov., 1977. 2 fig.

Keywords: Refeeding, Processed bovine waste, Composting, Separation techniques, Cattle, Performance, Economics, Odor control, Dust control, Fly control, Feedlot runoff, Economics, Costs.

After many years of trial and error and discouraging frustration, Dick Bunger (president of Corral Industries, Phoenix, Arizona) feels that he has a realistic, economical method of saving a feeder money on his cattle; of turning a waste into value; of reducing odor, dust and flies; of keeping the pens in better shape for the cattle and for handling runoff. Further, Bunger feels this might well be a substantial step forward, profitwise, for feedlots of 5,000 head and over from now on. What is he doing? He has developed a method of harvesting the manure from livestock and processing it into recycled feed at the total cost of only nine dollars a ton. This nine dollars includes all costs of collecting, operating the recycling system, the payroll, trucks, equipment, chemicals, interest, depreciation and maintenance. In experiments employing this product as feed, control cattle averaged 3.2 pounds daily gain, and processed bovine waste (PBW) cattle averaged 3 pounds daily gain. There were no death losses nor hospitalizations in any of the groups. Corral showed a 16 percent advantage in cost of gain with the PBW cattle over the controls, which figures out to five cents a pound per head per day. (Merryman-East Central)

4665-A6, B1, C2, D3, E3, F1
METHANE FROM CATTLE MANURE TO REPLACE FUEL OIL

Anonymous
Feedstuffs, V. 49, No. 47, p. 1, 39-40, Nov. 14, 1977.

Keywords: Cattle wastes, Energy, Fermentation, Recycling, Methane, Refeeding, Wastewater quality, Odor, Costs.

Construction is scheduled to begin in February on a prototype methane plant which could eventually make the Kaplan Industries feedlot and processing plant south of Bartow, Florida, totally energy self-sufficient. The project is funded primarily by a U.S. Department of Energy grant of $938,000 to Hamilton Standard, a division of United Technology of Connecticut, builder of the system. The prototype plant, an anaerobic fermentation system, will process manure from 10,000 head of cattle. Hamilton Standard projects production of $158,000 worth of methane gas and $350,000 worth of animal feed annually, with operating costs of $80,000. The system will both decrease odor and upgrade the plant's waste water system. (Kaplan presently uses a wastewater system which recycles fluid cattle waste into drinking water for the animals). L. W. Umstadter, assistant to the president and project manager for Kaplan, said the plant should be ready for operation in late 1978. (Bates-East Central)

4666-A8, B3, C2, E2
STUDIES ON POULTRY MANURE IN RELATION TO VEGETABLE PRODUCTION. II. POTATO

Department of Vegetable Crops, Haryana Agricultural University, Hissar, India
K. Singh, M. S. Minhas, and O. P. Srivastava
Indian Journal of Horticulture, V. 30, No. 3/4, p. 537-541, 1973. 2 tab., 16 ref.

Keywords: Poultry manure, Farmyard manure, Fertilizers, Nitrogen, Potatoes, Crop response, India.

The focus of this study has been to compare the value of poultry manure with farmyard manure (FYM) and to evaluate the requirement of nitrogen in the form of these organic manures alone and in combination with fertilizer to obtain better growth, maximum yield and good quality of potatoes. The experiment was conducted on an autumn crop of potato variety Kufri Sindhuri during 1968-1969 at Vegetable Experimental Farm, Punjab Agricultural University, Ludhiana, India, in randomized block design consisting of 16 treatments, replicated 3 times in 4 x 3 meter unit plots. Four doses of nitrogen (0, 80, 120, and 160 kg/ha) were applied as farmyard manure (0.84 percent N) and poultry manure (1.5 percent N) and in combination with nitrogenous fertilizer (ammonium sulphate) on a 50:50 basis. There was a progressive increase in the growth of potato plants with successive increments in the levels of nitrogen application through various combinations. A combination of poultry manure and fertilizer at the rate of 160 kg N/ha gave the maximum yield (14220 kg/ha). Poultry manure exhibited better response than farmyard manure on yield and its different attributes (height of the plant, number of shoots, and number of leaves per plant) at every level and combination. Crude protein and phosphorus concentration in the tubers increased considerably with the increasing levels of nitrogen while water soluble carbohydrates and starch contents were found to increase only up to the 120 kg N level and declined with the higher application of nitrogen. (Bates-East Central)

4667-A4, B2, C2, C3

SLURRY PROBLEMS IN RELATION TO POLLUTION OF SURFACE WATERS

Department of Agriculture, Northern Ireland and Queen's University, Belfast, Northern Ireland
J.S.V. McAllister
Semain D-Etude Agriculture et Environnement, Copte-Rendu Des Seances, September 2-6, 1974, p. 134-143. 5 tab., 11 ref.

Keywords: Slurries, Waste management, Water pollution, Land spreading, Literature reviews, Disease organisms.

The amount of slurry which can be safely spread on land depends on three factors: soil type, cropping system, and climate. A literature review is given concerning problems with land spreading of such wastes. Surface waters may be polluted when farm wastes such as slurry or silage effluent are able to gain rapid access to watercourses. Spreading wastes on land which is very wet, very dry with large cracks or which has porous backfill over field drains allows such rapid access to watercourses. Direct pollution of water may occur from silos of manure storage and housing areas when effluent passes through cracks or joints in well-made concrete structures and subsequently into drains. Waters may also be directly contaminated by disease organisms during the spreading of slurry either by direct runoff or by aerosol action. All farm effluents are rich in nutrients and have potential for causing eutrophication and secondary pollution. (Rowe-East Central)